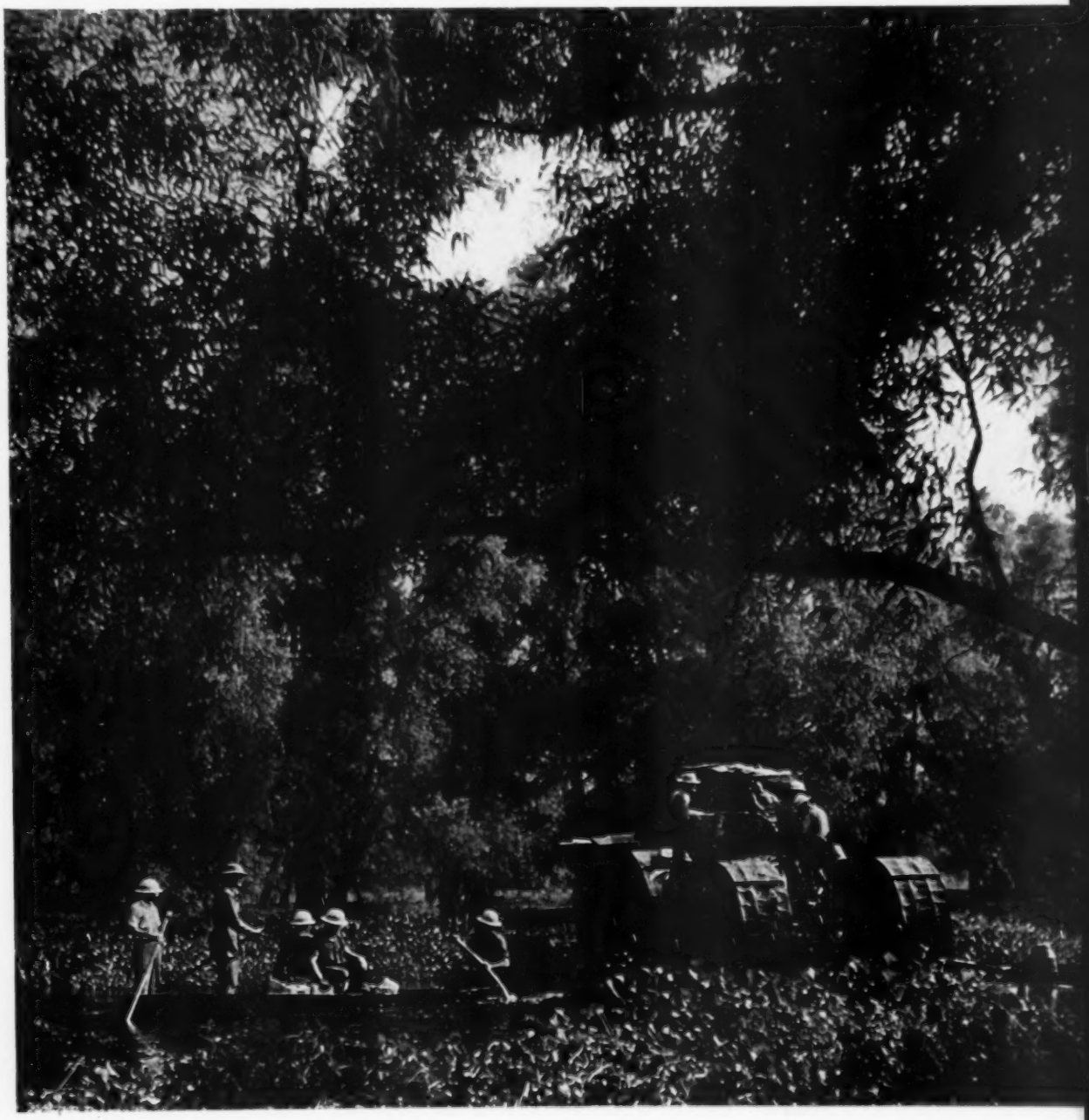
# World Petroleum



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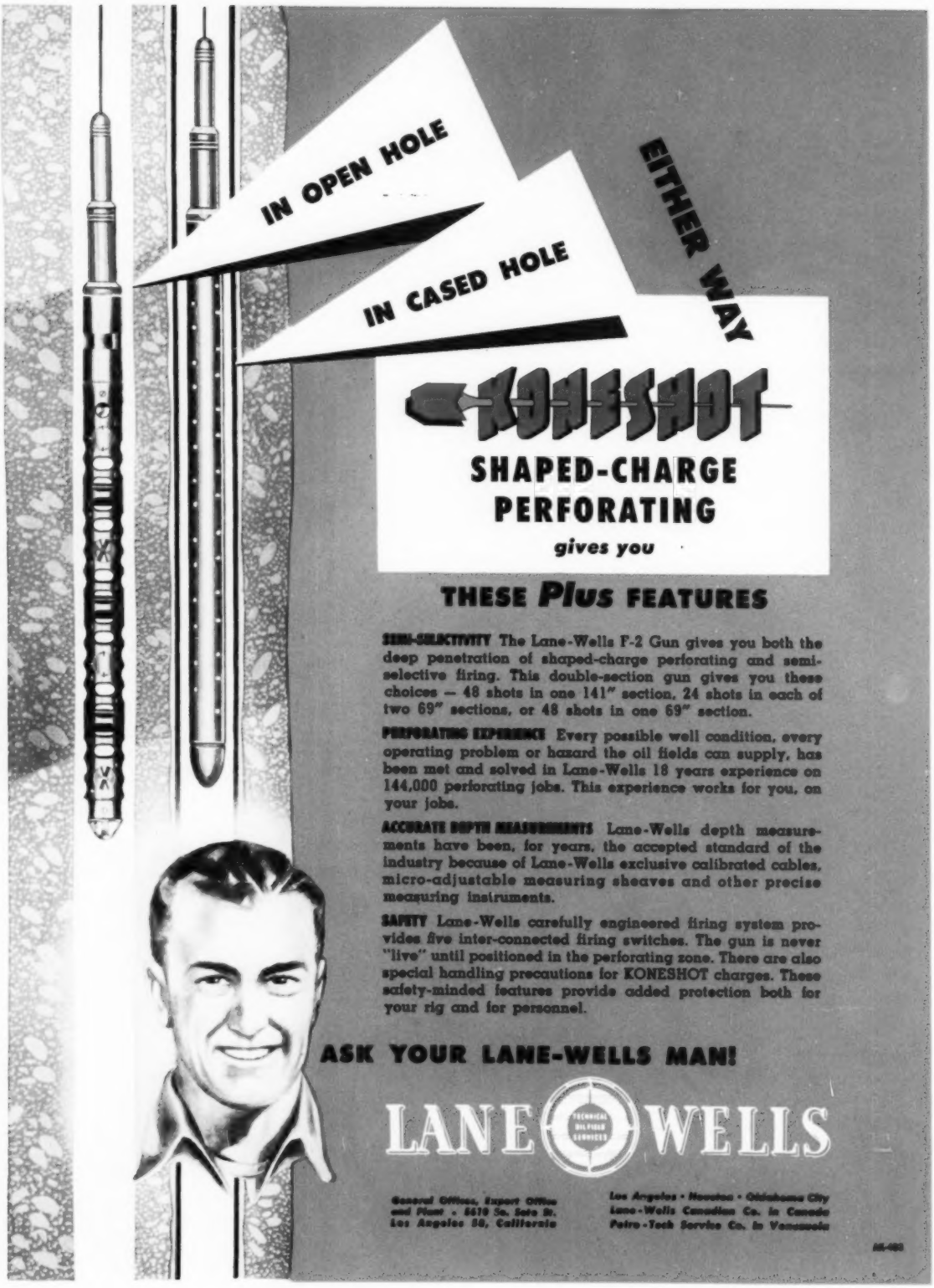
August 1951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KONESHOT
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PERFORATING
gives you
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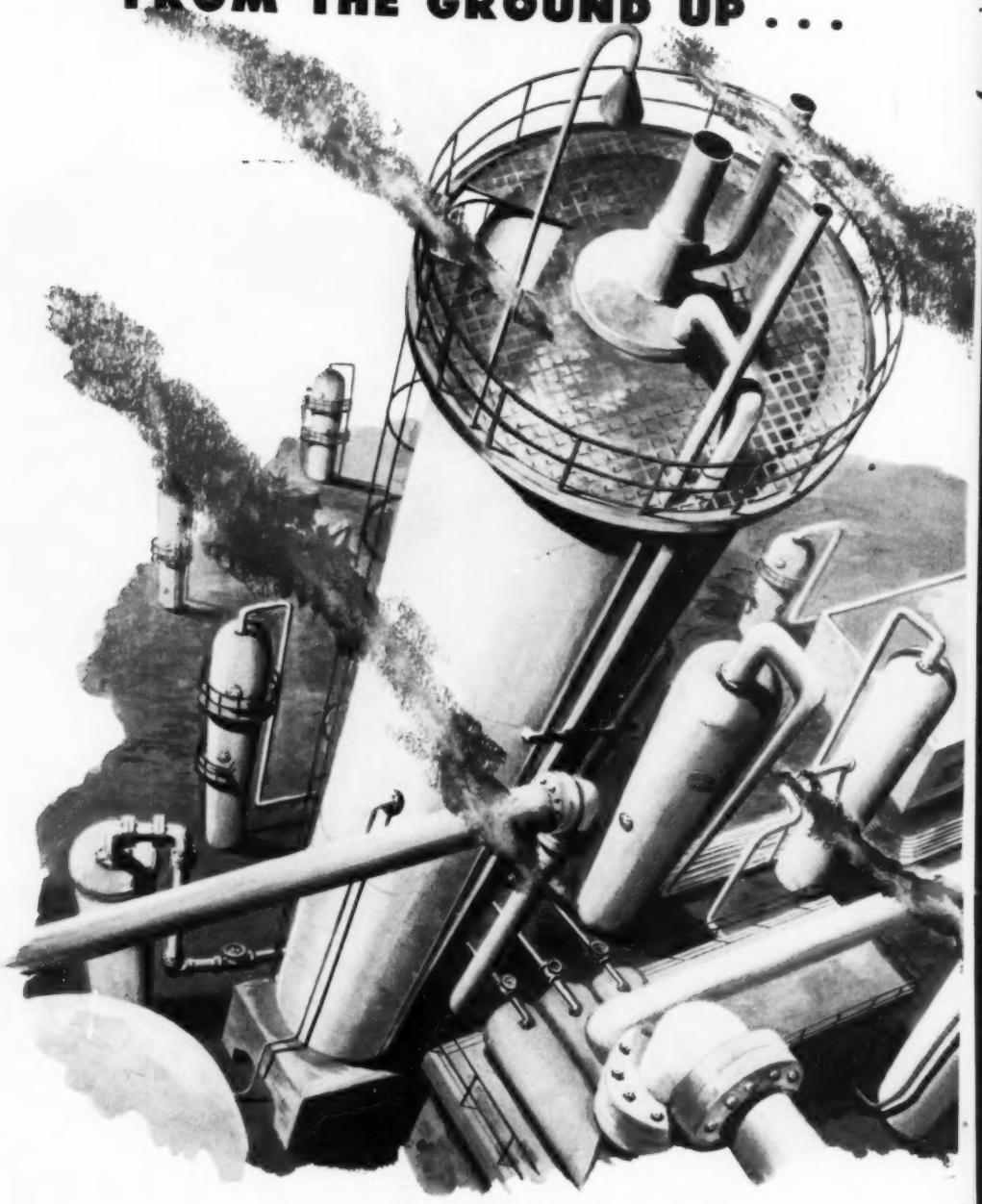
# FROM THE GROUND UP . . .



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# . . . AND THEN SOME

## that's UOP service

Universal Service lives with the job . . . all the way through from the first planning stage to engineering, construction supervision, plant completion and operator instruction.

Refiners everywhere, who have availed themselves of Universal Service know that it effectively contributes to more efficient day-to-day operation. Men who know refining processes and techniques from the ground up — men who are familiar with refinery problems and operations all over the world are available, on request, to assist you in maintaining peak operating performance.

Their help and advice is part of the *long range* plan that makes Universal Service so unique and important.

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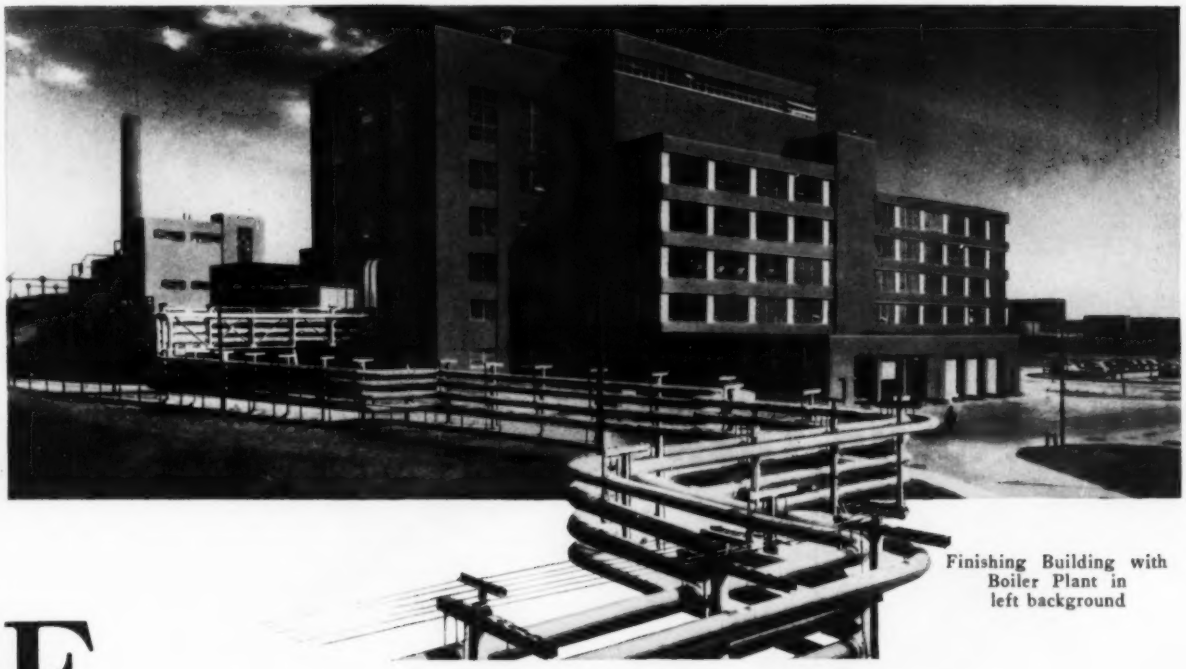
*Universal Service Protects Your Refinery*



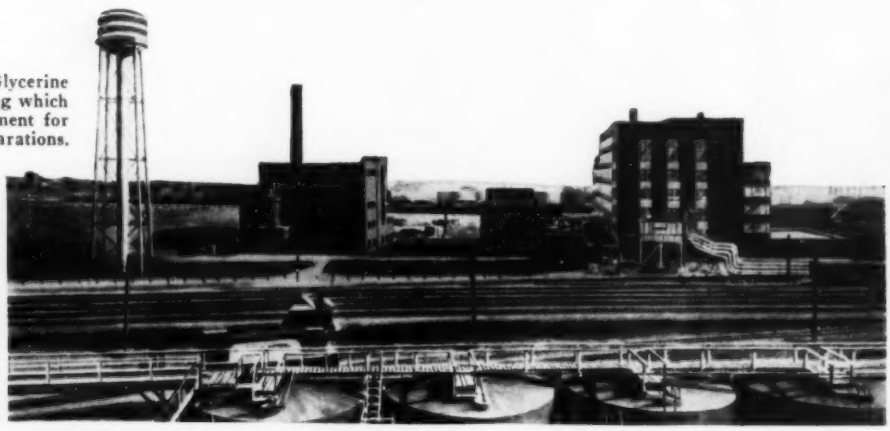
Finishing Building with Boiler Plant in left background

# FROM REPORTS . . . *to Producing Plant*

For Lever Brothers Limited, Stone & Webster Engineering Corporation prepared a series of reports covering alternative plans for consolidation and expansion of the company's manufacturing facilities in Toronto.

The resulting new plant facilities, selected to achieve more efficient and economical operation, were designed and constructed by Stone & Webster Engineering Corporation.

Left to right, Boiler Plant, Glycerine Refinery and Finishing Building which includes manufacturing equipment for soap products and toilet preparations.



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**A SUBSIDIARY of STONE & WEBSTER, INC.**

# Our Mr. Smith

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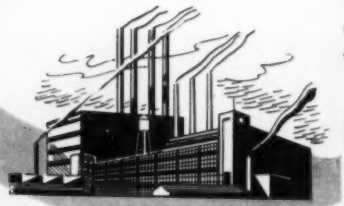
# TO STEP UP OUTPUT

## HALFWAY 'ROUND THE WORLD

**Caltex quality fuels and lubricants serve all industry and transportation**



MACHINES on the production line. Motors moving the earth for agriculture. Engines pulling vast loads over the land. Turbines driving ships at sea. Caltex quality fuels and lubricants keep them operating—efficiently, economically.

To do this Caltex does more than offer petroleum products. It offers half-world-wide reliable and convenient sources of supply. And—it offers the services of skilled lubrication engineers who see to it that Caltex in use gives greater output—and lower unit costs.

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# CALTEX PETROLEUM PRODUCTS

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Yours the problem - Harveys the answer!

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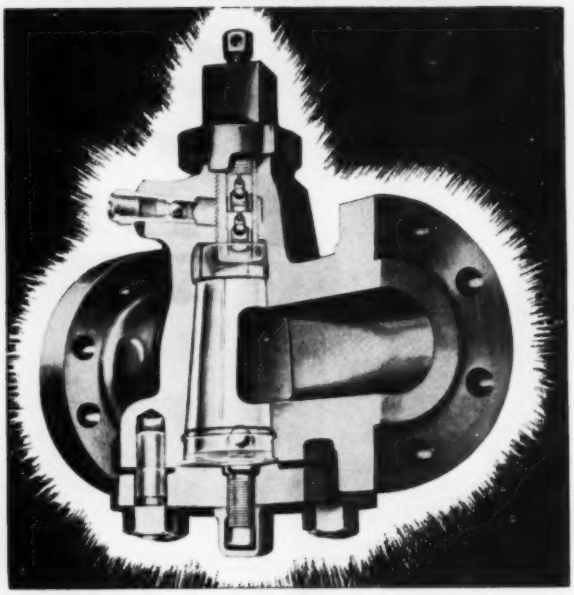
# THE VALVES THAT CAN "TAKE IT"

Audco-Nordstrom 2-Bolt Type

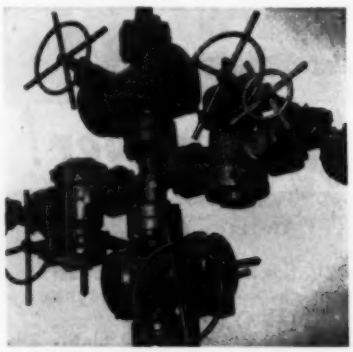


Audco-Nordstrom Hypreseal Type

## REPLACE TROUBLESOME VALVES WITH AUDCO-NORDSTROMS

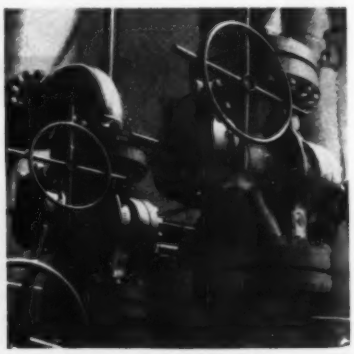
The best offense against leakage is a good defense. Bring up your present lines to top-notch condition by replacing old, troublesome valves with Audco-Nordstroms rather than trying to "patch" with valves that will again need replacement. By using Hypermatic lubricant, Audco-Nordstroms require only occasional attention, because Hypermatic gives the valves automatic lubrication.

They maintain lubricant pressure for longest periods so they keep in excellent condition, ready to operate, always easy to open or close. Audco-Nordstroms can be depended upon, in the toughest services, as attested by the countless installations in most of the Nation's pipe lines, and in practically every industry.



10,000-lb test valves on Christmas Tree

Nordstrom valves on de-etherizer charge pumps



Hypreseal valves in refinery

*Audco-Nordstrom*

BRITISH AMERICAN

## LUBRICATED VALVES

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# ANTIKNOCK COMPOUND

## A product the public never sees benefits everybody who makes, sells or uses gasoline and gasoline engines.

**Did you know** that over 98 per cent of the gasoline sold for motor use today is improved with antiknock compound? And that, because of antiknock compound, gasoline generally averages about ten octane numbers higher in antiknock quality than it otherwise would?

Antiknock fluid offers petroleum refiners a relatively inexpensive and convenient way of stepping up the power of gasoline. So it is easy to think of its use entirely in terms of benefits to the petroleum industry. However, the mixing of antiknock fluid with gasoline sets up a "chain reaction" which benefits vast numbers of people right down the line. Among these are:

**The automobile manufacturer** who can design engines to take advantage of high octane gasoline and so give more power and better mileage.

**The car owner** who enjoys the extra performance and economy of a high compression motor.

**The truck operator** who can carry more goods at lower cost because the extra power of high compression engines improves the performance of his trucks.

**The armed forces** who can pack more power into the engines that power tanks, self-propelled guns, military trucks and other vital equipment.

**The bus operator** whose passenger-mile costs are reduced as engine efficiency is raised.

**The farmer** whose tractor will do more work per gallon of fuel when it is equipped with a high compression engine designed for gasoline improved with antiknock fluid.

**The airline operator** whose engines require gasoline of extremely high octane number for satisfactory operation. (Aviation gasoline contains greater amounts of antiknock fluid than is usual in automotive gasoline.)

Thus, a product which most people never see benefits almost everybody. As a matter of fact, the widespread use of antiknock fluid is one of the basic reasons why *two* gallons of today's gasoline will do the work of *three* gallons of 1925 gasoline—yet the price per gallon, excluding taxes, is about the same.

**ETHYL CORPORATION, New York 17, New York**

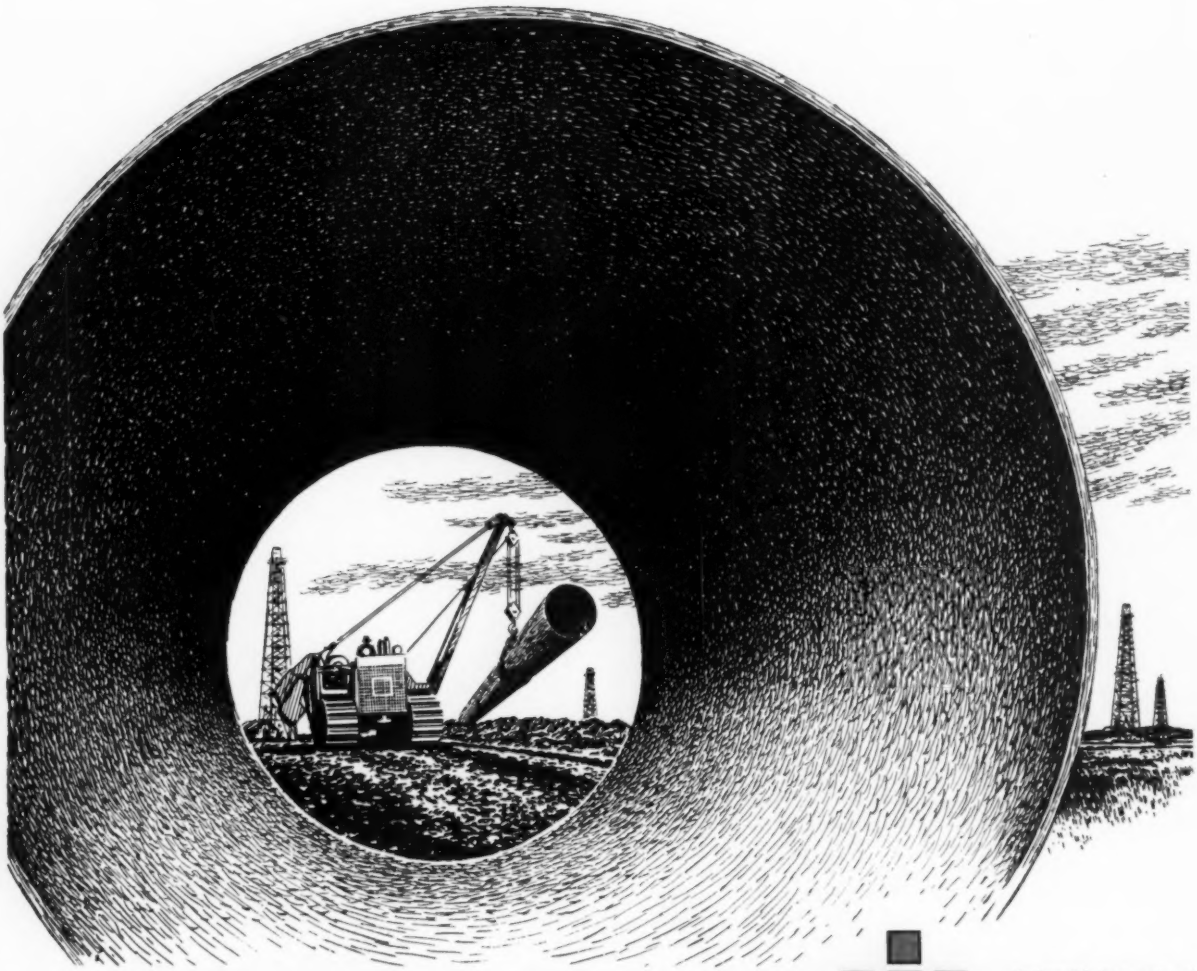
**Makers of "ETHYL" antiknock compound**

# When economic health comes by the gallon!

Healthy industries make healthy nations. For example, petroleum is a *basic* industry that must maintain and increase its production. When it does, a multitude of other industries prosper with it.

Rugged International Diesel tractors, power units and related equipment serve the petroleum industry well. They handle *every* power job; they clear and level land for drill rigs, man the pumps and lay pipe a hundred miles or more.

Consider the *basic industries* that make up the *physical and economic security* of your nation. International Harvester contributes strength to these industries by providing the necessary tools for transport, agriculture and all phases of earthmoving and construction. International Harvester Export Company, 180 N. Michigan Ave., Chicago 1, U.S.A.



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# *Up from Lake Charles...with Cities Service!*

For the past decade, during Cities Service's wide and rapid expansion of its petroleum processing facilities, Kellogg has worked closely with this refiner in the design and construction of several vast undertakings.

First job was a mammoth refinery at Lake Charles, Louisiana. The first complete modern refinery to be built from the ground up, it included three catalytic crackers...and alkylation, deasphalting and crude topping units as well as all plant-site facilities. Concurrently, a butadiene plant was built on an adjacent site.

Immediately following World War II, Kellogg undertook the complete modernization of the Cities Service East Chicago 35,000 BPD refinery . . . engineering and constructing new Fluid catalytic cracking, delayed coking and light ends fractionating units as well as revamping other facilities.

Today sees Kellogg at Ponca City for Cities Service. It is another major modernization job with Fluid catalytic cracking as the principal new process.

## THE M. W. KELLOGG COMPANY

A SUBSIDIARY OF PULLMAN INCORPORATED

*for fifty years an integral part of processing history*

NEW YORK JERSEY CITY LOS ANGELES TULSA HOUSTON TORONTO LONDON PARIS

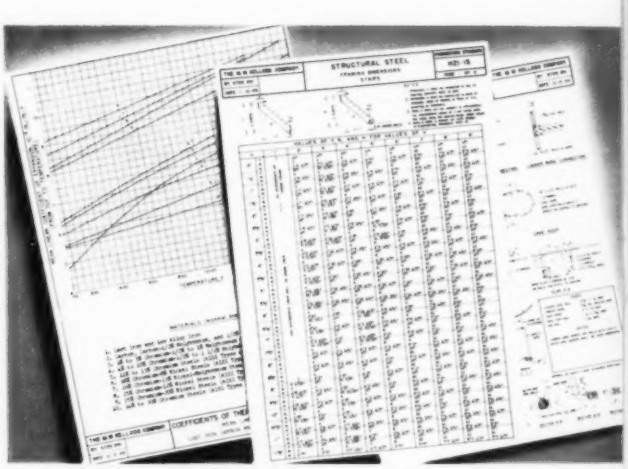
# Portrait at

*This year is Kellogg's fiftieth of service to industry. At this time naturally, as a group of men—known collectively to the modern business world as The M. W. Kellogg Company—we can think back nostalgically. We can remember the chimney stacks*

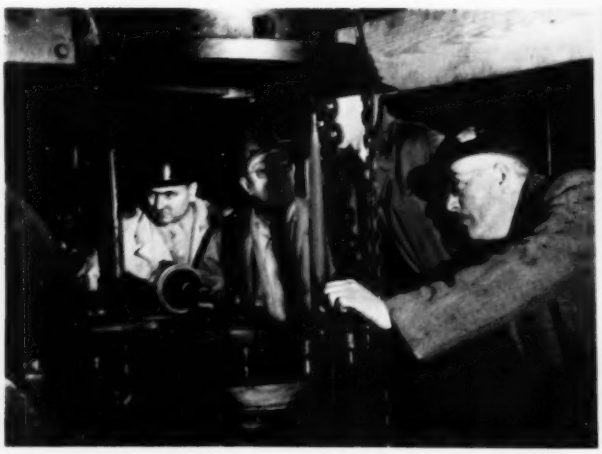
## "Firm Foundation for Every Task"

*Camera "portraits" of M. W. Kellogg today, appearing in preceding issues of this publication, have reviewed the research, development, process design and design engineering phases of the Kellogg operation.*

*This month, the camera looks at the vital task of collecting, evaluating and disseminating Technical Data and Standards . . . and then indicates how this basic work influences Procurement practice and efficiency.*



**1.** ***THE PRACTICE OF ENGINEERING*** is similar to most professional operations . . . highly individual in its approach to problems. But unless ***the best*** of each engineer's approach is captured for the benefit of others, much individual effort would be repeated on the same problems. Thus, at Kellogg there is a special ***Standards Group***—engineers, whose sole function is to record the best methods for solving many problems.



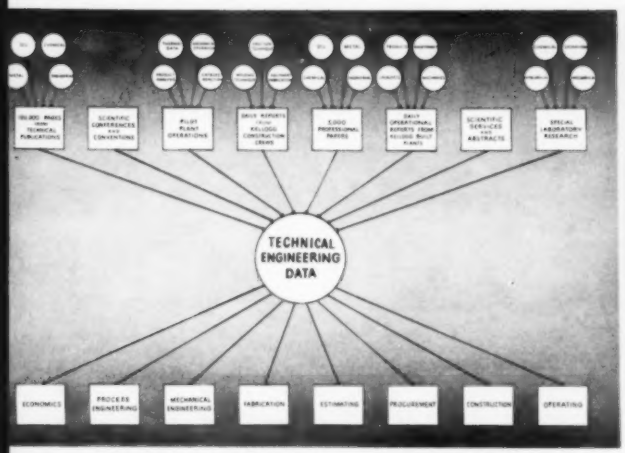
**4.** ***CONSTANT CHECKING*** and re-checking of design specifications is the responsibility of all Kellogg engineers who regularly visit operating units. Such visits are scheduled when possible for turn-around periods so that the company's engineers can inspect process equipment and personally observe how Kellogg design stands up in actual practice.

**5.** ***DESIGN STANDARDS*** and detailed specifications are obviously most important in the design function of the company. But they also contribute greatly to the efficiency of such a major function as ***Procurement***. Kellogg's procurement force is a large one, issuing more than 60,000 purchase orders a year, on the average. The availability of detailed specs on all items regularly purchased speeds the procurement job measurably.

# Fifty... no 7

KELLOGG
1901-1951
50th Anniversary

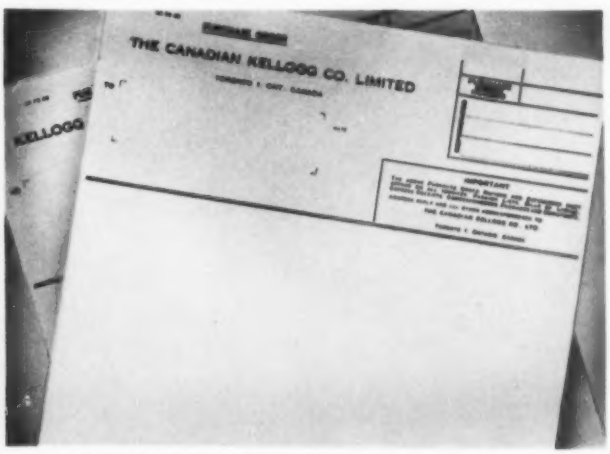
*we built in 1901 . . . the first crude vessels for oil refiners in the 'teens . . . our first combination unit. The forty-odd Fluid cat crackers built in these years. But, after all, The M. W. Kellogg Company is only a factor as it is able to serve industry today. For that reason, we are presenting this series of monthly camera studies which document our belief that a truly integrated organization can better serve industry to achieve greater earning power. This is No. 7 in the series.*




**2.** ***THESE BEST METHODS*** are then made available to the entire engineering organization in the form of "Standards." Kellogg design standards, of course, embrace recognized codes, but they also project and amplify the codes for more efficient engineering and operation. Another group of engineers, with a supporting staff, specialize exclusively in the gathering, evaluation and dissemination of ***Technical Data***.

**3.** ***THIS SIX-VOLUME SET*** is literally priceless. While it includes much information that is available to the entire engineering fraternity, it also includes much more that is exclusive. It contains Kellogg's own research and development data, *plus* the summarized analyses of operating data from the more than 450 process units designed by the company during modern processing history.

**6.** ***ORGANIZATION OF THE PROCUREMENT GROUP*** closely parallels that of the Engineering Departments. Buyers specialize in specific phases such as vessels, equipment, instruments, etc., and in classes of materials and services. Thus, each specialized buyer has the direct support of the technical knowledge of the ***matching*** engineering group.




**7.** ***KELLOGG PURCHASING SPECIALISTS,*** because of their close integration within a complete engineering-fabricating-contracting organization, are in an advantageous position to weigh delivery dates against price. Correct decisions between these factors are particularly important when they govern the starting date of plant ***earning power***. Worldwide facilities also speed procurement and consequently project completion dates.

## NEXT MONTH

***. . . in the eighth in this series of camera studies of M. W. Kellogg today . . . you will see how Kellogg's original bent for manufacturing serves the company today in meeting engineers' toughest "specs".***

# Putting the squeeze on Process Piping!

## M. W. KELLOGG

*This special machine put the squeeze on the first 30"O.D., chrome-moly piping to be successfully corrugated. The Kellogg technique of incremental heating and working employed in this operation has many other advantageous applications in fabrication of refinery equipment.*

**Special Studies** of unusual problems such as stress corrosion and graphitization to assure long life and low maintenance.

**Exclusive Equipment** for accurately analyzing stresses in piping and providing unique data for critical installations.

**Top Welding Performance** in shops and in the field by welders accustomed to working under X-ray checks.

**Metallurgical Research** by recognized specialists who have made major contributions in this field.

**Complete Facilities** for the fabrication of steel products from simple forgings to specially cast bimetallic devices.

**Rigid Quality Control,** devised by specialists, including chemical and micro analyses as well as mechanical and non-destructive testing.

Pressure Vessels
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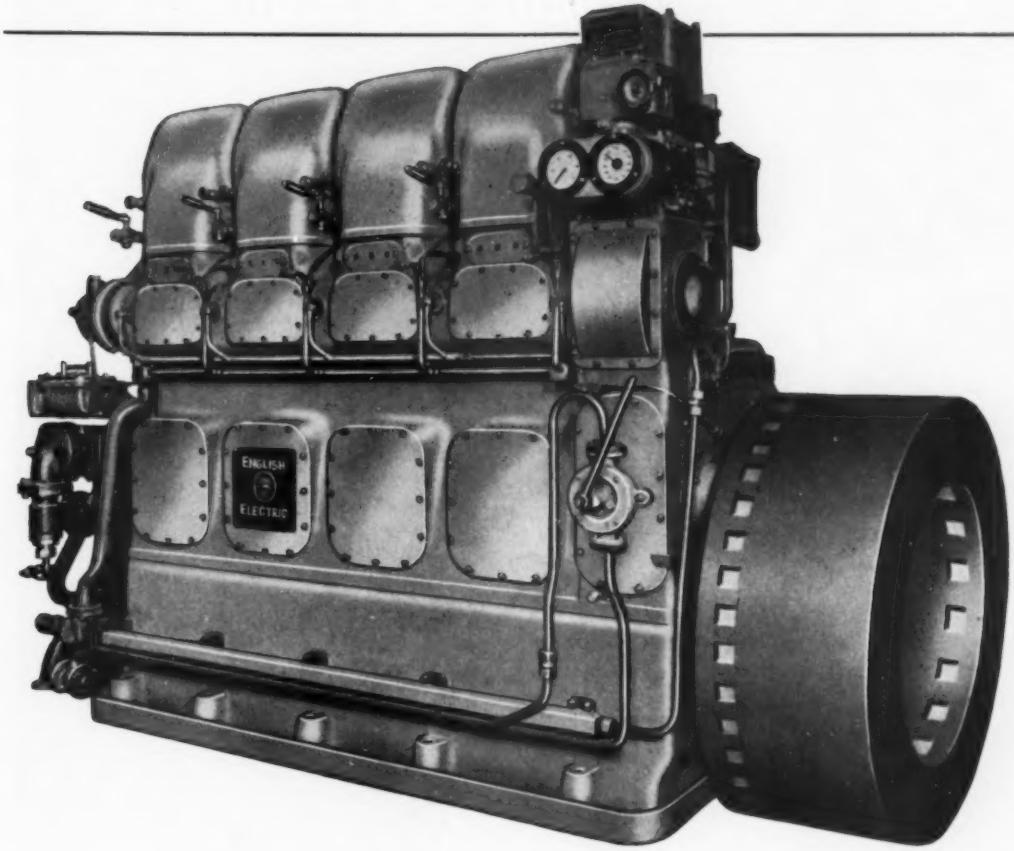
**NEWS FOR OPERATORS IN WESTERN CANADA!**

Canadian Kellogg Company has established complete shop facilities for the fabrication of all types of piping at **EDMONTON** in Alberta Province. Inquire directly or through any Kellogg office.

**The M. W. Kellogg Company** *(A Subsidiary of Pullman Incorporated)* **New York, Jersey City, Los Angeles, Tulsa, Houston, Toronto, London, Paris**

# 'ENGLISH ELECTRIC'
## dual-fuel engines

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**Outputs from 132 b.h.p.**

Running on Town, Natural, Producer or Sewage Gas (Methane), these units require the minimum quantity of fuel oil for pilot injection, and give the same output on gas of a high calorific value as on fuel oil. Changeover from gas to oil is automatic if gas supply fails.

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Diesel Engine Division, Rugby.

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to obtain
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*from "The Pipe Book"*
*by Alfred Dunhill*

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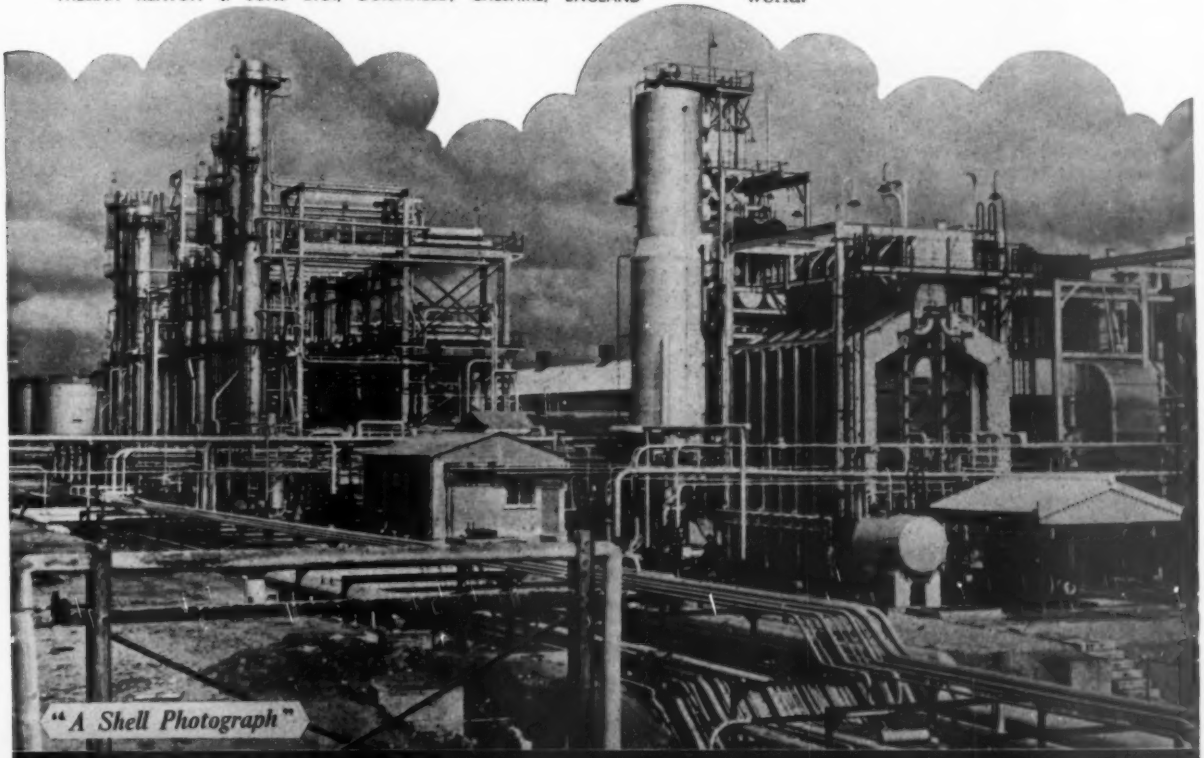
### STAFFORDSHIRE PIPE

Pottery and porcelain manufacturers have often used the pipe as a subject for their craft, for ornament rather than practical use. Elaborate coiled or snaked pipes were made of Staffordshire ware, of which a beautiful specimen is shown.

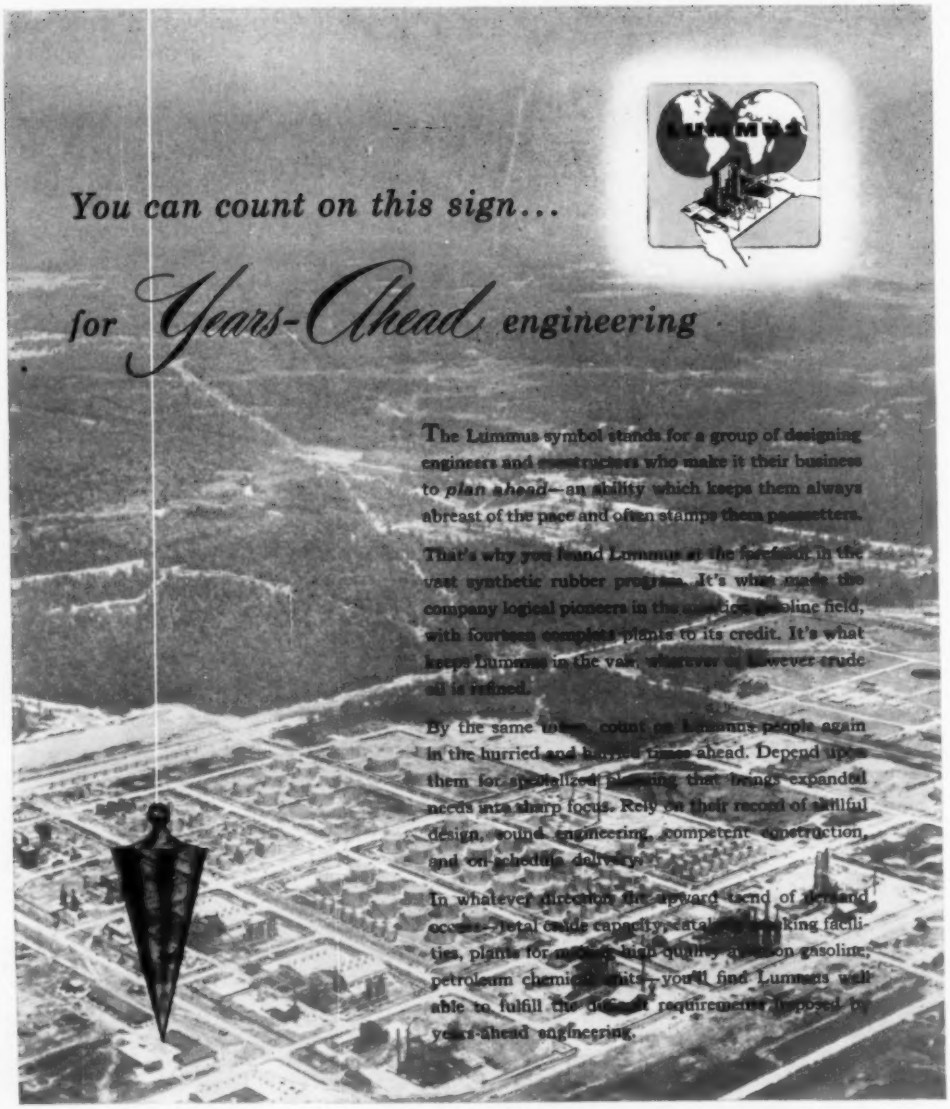
### INDUSTRIAL PIPING

Piping for industrial purposes should be practical and efficient. Heat insulation of pipes and equipment minimises heat losses occurring in your plant. Have a survey made by a KENYON engineer; he will show you how KENYON planned heat insulation will save.

Projects carried out in every part of the world.




**KENYON** *Planned* HEAT INSULATION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for Years-Ahead engineering
The Lummus symbol stands for a group of designing engineers and constructors who make it their business to plan ahead—an ability which keeps them always abreast of the pace and often stamps them pacesetters.
That's why you found Lummus at the forefront in the vast synthetic rubber program. It's what made the company logical pioneers in the expanding gasoline field, with fourteen complete plants to its credit. It's what keeps Lummus in the van, wherever or however crude oil is refined.
By the same token, count on Lummus people again in the hurried and harried times ahead. Depend upon them for specialized planning that brings expanding needs into sharp focus. Rely on their record of skillful design, sound engineering, competent construction, and on-schedule delivery.
In whatever direction the upward trend of demand occurs—total crude capacity, catalytic cracking facilities, plants for making high quality aviation gasoline, petroleum chemical units—you'll find Lummus well able to fulfill the different requirements imposed by years-ahead engineering.

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DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

# WORLD PETROLEUM

*The Management Publication of the International Petroleum Industry*


**MONA PALMER**
*Publisher*

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***THIS MONTH'S COVER***

The swamp buggy shown in this photograph by Fritz Henle is hauling a Cities Service seismograph crew through the Louisiana swamp country en route to the location where shooting is to be done. Color plates are reproduced through the courtesy of Service, house magazine of Cities Service Co.

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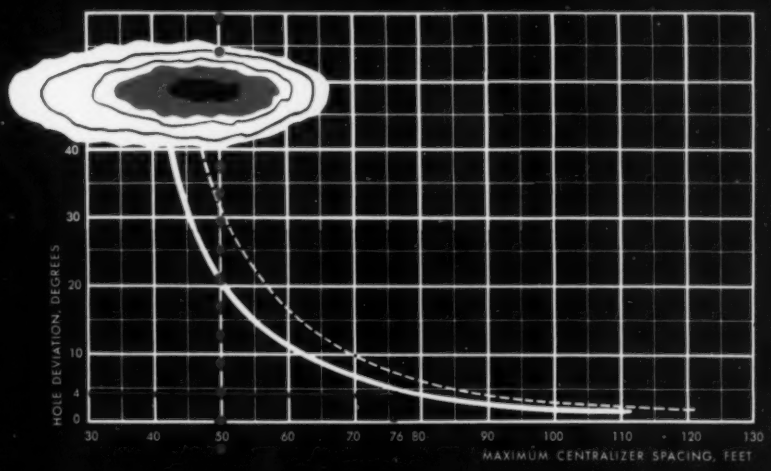


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# Oil Industry's Rising Cost of Living

As part of the program of strengthening national defense the oil industry of the United States has been asked to drill a minimum of 43,000 wells during 1951. With military requirements imposed upon a rapidly rising civilian consumption and adding a million barrels to daily domestic needs it was obvious that more oil must be made available to safeguard reserves from the threat of dangerous depletion. At the end of the first six months completions had risen above 20,000 and it is evident that the goal will be reached or perhaps passed providing the necessary steel and other materials for fulfilling the schedule can be made available.

In another phase of the preparedness movement it was necessary to provide processing facilities to take care of greater production since existing refineries early in the current year were operating within five percent of their total capacity, a dangerously narrow margin. Consequently, the Petroleum Administration for Defense has issued authorizations for the addition of 550,000 barrels daily to the country's refining capacity with the expectation that the target will be raised still higher. In these arrangements emphasis naturally has been placed upon the provision of products especially needed for military use, such as high test aviation gasoline at one end of the refining cycle and heavy fuel oil at the other, lubricants shaped to severe requirements, butane, propane, toluene and other specialties. To move the larger output thousands of miles of line pipe must be laid; tank cars and marine carriers must be built. Ocean going supertankers capable of being converted to war vessels must be added to the naval equipment. Terminals and storage facilities must be erected.

Aside from the expansion dictated by national security the industry is under the necessity of keeping pace with the still swiftly rising demand for petroleum products. The increase for the current year over 1950 is estimated at ten percent. This means that another increment of more than a half million barrels daily must be added all along the line to cover the normal rise in consumption and to maintain the rather close balance between supply and demand. This is in addition to the special requirements of the rearmament program. For the refining branch of the industry there is also the necessity of replacing the plant capacity that becomes obsolescent year by year.

In common with all other forms of enterprise the oil industry is faced with a serious problem in its rising cost of living. Its wage bill, the cost of the materials it uses and especially its tax burden, all have multiplied in the past decade while the price of its own products, aside from the taxes it collects for federal and state governments, which of course do not figure in its income, is about the same as a score of years ago. Petroleum products are among the very few that have not been protected by increasing prices to correspond with the dollar's declining worth.

For the past five years American oil companies have expended an average of more than two thousand million dollars to find and produce more oil, to provide improved facilities for its processing and increased capacity for moving it. To provide the funds for this huge capital investment the industry has applied to this purpose a major part of its earnings, and to a minor degree has increased its short and long term indebtedness. How to maintain this procedure in the face of rising costs and higher tax exactions is a serious problem.

Some interesting figures as to the current cost of enlarging oil industry operations were presented by Thomas W. Phelps of Socony-Vacuum Oil Company in a recent talk before the Empire State Petroleum Association. He estimated that to find and develop additional crude production in the United States involves an expenditure of $2,300 to $2,600 for each barrel so added. Increased refining capacity, diversified to meet today's needs, is estimated at about $1,500 per barrel-day. Transportation cost varies with distance and the method employed but the provision of long line pipe capacity is put down at roundly $500 per barrel. Including other costs incident to an increased operating volume, it would not be far amiss to calculate the investment required to increase available oil supply by a million barrels daily at approximately five thousand million dollars.

While the figures quoted apply to the cost of increasing output in the United States, it is probable that the required investment for operations in other countries does not differ greatly. Much of the world's oil is found in isolated areas where large expenditures are required for housing, roads, communications and social services.

Among the obstacles to a continuation of the industry's self dependence in meeting the constant demand for more and more of its products are the heavier exactions imposed year by year by local and national authorities in the areas where it operates. Oil has long been a favorite target of the tax eaters. A recent compilation prepared by the National City Bank of New York shows that among industrial groups the proportion of taxes to sales revenues is higher among petroleum companies than in any other section except firms engaged in the liquor and tobacco trades. During the first quarter of 1951 taxes took 58 percent of operating earnings as compared with 44 percent in 1950. Measures now pending before Congress, if adopted, will greatly increase corporate income taxes and add an excess profits tax rising to 82 percent under some conditions. Exactions which approach confiscation discourage the investment of new capital.

# Chemists Attack Oil Recovery Problem

***Field tests in California, Oklahoma and New York are successfully using chemicals to strip important quantities of oil by chemical methods from watered out oil sands previously considered exhausted.***

CHEMICAL engineers have invaded the producing branch of the oil industry. Having previously taken over much of the new process development work in refining, the chemists now are suggesting that the physicists and mechanical engineers move over and make room for them in this field also.

Through the conservation of initial reservoir energy and by supplying outside energy, the physicist and mechanical engineer have vastly increased the availability of petroleum in the past generation. Thirty years ago producible oil was on the order of 30 to 50 percent of the content of most reservoirs. Through successive applications of energy such as vacuum, gas repressuring and water flooding, the percentages have been more than reversed. Today the typical field will produce 70 to 80 percent of its oil content.

Prime problem facing the industry's researchers is how to remove the remaining oil residue clinging tightly to the surfaces of reservoir rocks. The most logical attack now appears to be chemical methods of breaking the bond between oil and rock surface and reducing the viscosity of residual oil to facilitate its movement through the permeable reservoir toward boreholes and increasing the effective permeability of the porous rocks.

The chemists have as their goal the production of some part of the 20 to 30 percent of the residual oil which is not now recoverable. This is no mean quantity. In the United States for example, cumulative production of crude to January 1, 1951 was 41 billion barrels and at that time known reserves were about 25 billion barrels exclusive of natural gas liquids. Assuming that the sum of these two figures represents roughly 70 percent of the oil which has been discovered it may be calculated that there are nearly 30 billion barrels in the ground for the chemists to work on. For each one percent increase in final recovery the United States crude reserves will increase about one billion barrels.

The Pennsylvania Grade Crude Oil Association and a considerable number of private researchers have been at work for some years on the chemical as well as the physical and mechanical aspects of oil recovery. Much of the work has centered on chemical methods of keeping water input wells receptive, largely through purification of the flood water. Injection of acid has aided recovery in the immediate vicinity of boreholes through the solution of lime formations. Detergents have been tried as a method of washing oil from the formation. Much of the past work has succeeded principally in speeding up the rate of production and making secondary recovery operations economic.

Two developments which have been made public recently suggest that research of the past few years is beginning to yield results of very great economic importance. First such announcement[1] was by James W. Martin and associates of the Oil Recovery Corp.[2] that injection of carbon dioxide in water flood operations will greatly increase recoveries.

Most recent disclosure is that of Paul D. Torrey of Houston, well-known secondary recovery expert, who has organized Oil Recovery Chemicals, an entirely separate company, to exploit the use of certain fatty acids and ammonia salts as flood water additives. Such chemicals are primarily designed to aid in bringing about a satisfactory permeability of the sand, either per se or as corrosion inhibitors when an acid flood water is used. These may be used alone or in conjunction with $CO_2$. Chemicals employed by Mr. Torrey are manufactured by Armour & Co. at a plant in McCook, Ill.

Due to the almost limitless variation in producing formations as well as the complexity of crude oils Mr. Torrey does not offer his chemicals to the industry by the barrel with directions on the label as to how they are to be employed. His plan is to examine each case separately and prescribe types and quantities of flood water additives which appear most appropriate. Oil Recovery Chemicals is opening a laboratory at Austin, Texas, to make these individual studies.

The ORCO ($CO_2$) process developed by Mr. Martin gives varying results in different fields depending on formation, chemical constituents of the crude and amount of gas remaining in the formation. It may or may not be applied in conjunction with fatty acids and does not require a corrosion inhibitor to protect surface or subsurface equipment.

Some insight into the future possibilities of chemical methods of stripping residual oil is seen in the results of laboratory work on samples of reservoir work. In the laboratory the oil content of thousands of core samples has been lowered from the 25-30 percent range to as low as 5-8 percent. If this could be translated cheaply into commercial field practice the effect on recoverable reserves would be of great economic importance.

First commercial application of the $CO_2$ process was begun at the close of 1949 on a Bradley Production Co. lease in Alleghany County, New York. The property had an ancient and honorable history as a producer of Bradford type crude. Discovery of oil in the immediate area was in June, 1879 at Petrolia, and by 1881 when the Porter Amber pool was developed in the South Bolivar district the whole region was in an immense oil boom.

Natural production by flowing and pumping continued until 1920 when the first water flood was undertaken. The lease then was nearly 50 years old and had given up perhaps 50 percent of its original oil content. In the past 30 years of oil flooding the operators have drilled more and more intensively to flood out any part of the sand which might have been bypassed. Peak production under water flooding in the early 20's was about 90 barrels per well per day. By 1947 re-drilling was so intensive that distance between input wells was only 140 feet. When the $CO_2$ experiment was begun in 1949 the property had passed its economic limit. Production was down to 0.25 barrel per acre per day.

Injection of carbonated flood water brought output of the test well to a peak of 4.2 barrels per acre per day and after 17 months the decline, following a typical curve, was down to 1.4 barrels per acre per day, nearly six times the production before the experiment began. Total production for the 17 months was 1,260 barrels per acre. Untreated parts of the lease produced one tenth as much in the same period.

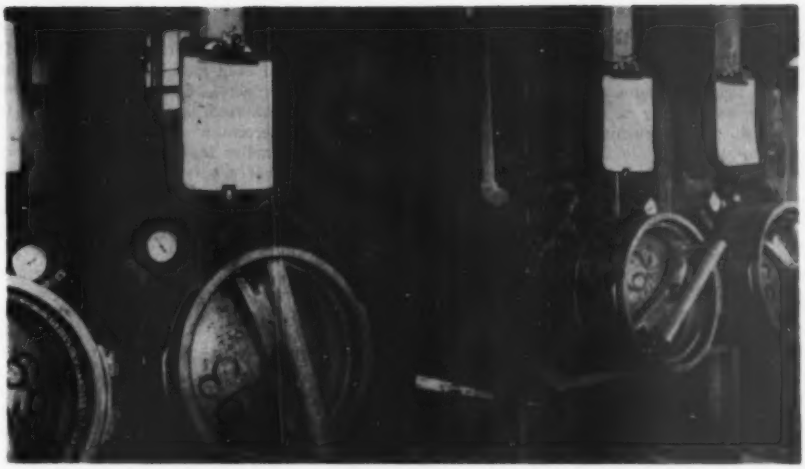
Core analysis at the outset of the test showed a residual oil content of 33 percent of the pore space. With 42 feet of pay sand the lease was calculated to contain 8,000 barrels per acre of residual oil when the test began. Present estimates are that the pilot test area will yield a maximum of about 3,000 barrels

[1] World PETROLEUM, March 1951—page 94.
[2] Officers and directors of Oil Recovery Corporation, 405 Lexington Ave., New York, include Francis Kernan of White Weld & Co., R. C. Schmidt and J. K. Schemmer of J. H. Whitney and Co., Henry Sears and Charles E. Saltzman of Henry Sears and Co., William Zeckendorf of Webb and Knapp, Inc., and James A. Bentley, management consultant.

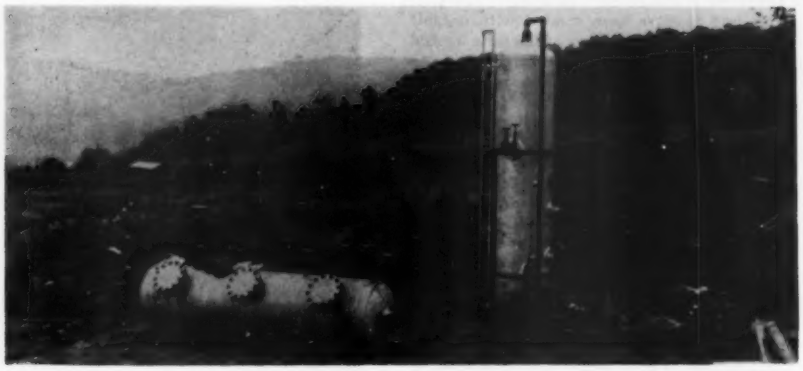
per acre before production declines again to an uneconomic level.

In other areas where more favorable conditions exist, Mr. Martin expects to recover a much greater percentage of residual oil than on the Bradley property. The sand on this property is very tight and the remaining gas content is small, totaling only 25 cubic feet per barrel of oil. Advanced age of the property is responsible for this. Presence of natural gas in the formation adds materially to the effectiveness of the $CO_2$ in stripping the pay so that the ideal time to begin injection of the chemical is at the beginning of the water flood.

In a full-scale commercial operation covering a tract or unit of adequate size the economic method of operation would be to install a $CO_2$ recovery plant or to pipe the chemical from a nearby source. The Bradley lease was, of course, a pilot test and did not warrant such a plant. The $CO_2$ was shipped in as dry ice.

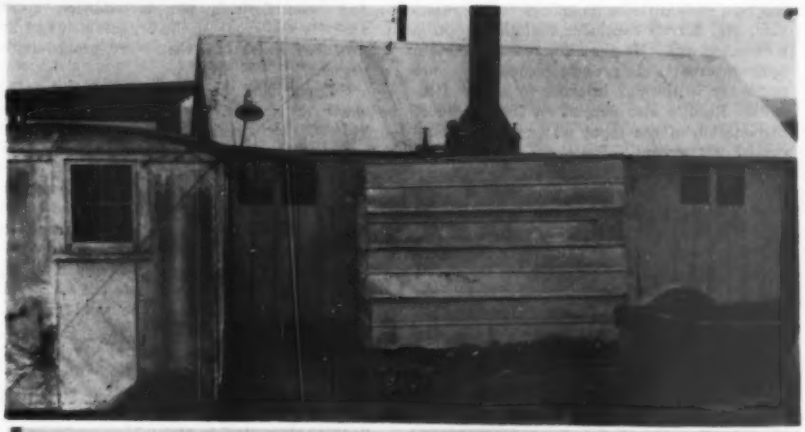


Pressure cylinders (20 feet x 12 inches) used to convert dry ice into gaseous or liquid carbon dioxide on Bradley Production Co. lease.



View of gas separator placed at mouth of Bradley producing well.

Two views (below) of buildings housing converters, dry ice storage box, and small water heater used to furnish hot water for melting the dry ice.



Equipment at the lease is quite simple. It consists essentially of a series of pressure drums in which the dry ice is permitted to vaporize at atmospheric temperatures in summer or with the aid of warm water spray in winter. At 70°F. $CO_2$ exerts a pressure of 1,000 psi which is the desired injection pressure on this lease. The $CO_2$ gas is mixed with incoming flood water by intermittent injection of $CO_2$ and water through the same tubing. Crude from the center well of the five-spot is flowed with a small back pressure to a separator where entrained and dissolved gases are eliminated.

On commercial operation the $CO_2$ and natural gas from the separator will be recycled. Pilot tests indicate that 70-80 percent of the carbon dioxide injected into the input wells can be recovered and recycled.

Carbon dioxide is a common product in oil and gas fields of the United States. It is available as a by-product of all Girbotol plants of which there are several thousand operated by the oil industry. Several synthetic ammonia plants yield $CO_2$ as a by-product in excess of 500 tons daily. There are many cement plants in the oil fields with a supply of the gas within easy piping distance of water flood prospects. Where such supplies are not available, $CO_2$ can be produced by controlled combustion of fuel oil or of formation gas. The estimated cost of commercial quantities of $CO_2$ required is estimated at about $15 per ton. This figure contemplates a 10-year plant amortization.

Second field test of the Martin process was begun early this year on a lease in the

Bartlesville sand area of northeastern Oklahoma. This also is in a depleted sand region with a history of flowing, pumping, vacuum and flooding. The Oklahoma test is on a larger scale than the first one in New York. Four five-spots covering an area of 10 acres are included. There are nine input and four producing wells.

In this test $CO_2$ is being purchased from a nearby synthetic ammonia plant in liquid form. One well is given an injection of 7.5 tons of $CO_2$ each day while the remaining eight are receiving water. Under this plan each input well receives carbon dioxide every ninth day. Results being obtained in this test have not been announced as yet.

Mr. Martin, originator of the ORCO process, has spent most of his active life as a chemical engineer in the carbon dioxide field. Exceptions were during the two world wars when he was engaged in explosives work for the government.

He became interested in the oil industry first as a result of field surveys to determine how much $CO_2$ is available from oil field operations. His survey convinced him that there are almost unlimited supplies so his next problem was to find more uses for it.

In his work as chief engineer of Dry Ice Corp. he had observed that $CO_2$ affected the lubricating oil in his compressors, appearing to change its chemical characteristics in certain ways. Later, when he was attempting to build new markets for $CO_2$ and had become somewhat familiar with oil producing problems, he began the laboratory work which has resulted in the new process. He has been aided in this work over a number of years by the Montclair Research Laboratories, Earlougher Engineering Laboratories at Tulsa and by Mr. Torrey at Houston as consultants.

Since the addition of $CO_2$ as practiced in the field adds little or no energy to the reservoir, Mr. Martin concludes that the action is a chemical one. He has observed that certain temperatures and pressure conditions are necessary in the pay in order to get good results. Results also depend on the degree of carbonation of the input water which should exceed 20 percent. Pressures should be in excess of 500 pounds. Although the 63° temperature and 1,000-pound pressure in New York has given good results, it is anticipated on the basis of laboratory results that the 85° and higher temperatures existing in the southwestern pay zones will be helpful. Above 500 psi the solubility of $CO_2$ in crude oil increases rapidly, indicating a chemical reaction between the carbon dioxide and some of the components of the crude oil after the critical pressure is exceeded.

Mr. Martin has found that under proper conditions some of the constituent compounds of crude oil react with $CO_2$ to produce unstable solvents or surface active compounds. As a result parts of the oil tend to act as a displacing agent for the remainder of the oil. When the gas and oil mixture is separated at the surface and pressure reduced the compounds largely revert to their original state with the possible exception of the lighter hydrocarbons.

The $CO_2$ appears to have a mild dehydrogenating effect on light hydrocarbons at the temperatures and pressure employed and the viscosity of the oil is lowered enough to facilitate movement through the porous medium. Natural gas production is increased largely. On the Bradley lease, for example, where gas content of the oil is only 25 cubic feet per barrel the well has produced 300 cubic feet per barrel during the carbon dioxide flood. It is considered even more significant that the produced gas increased in unsaturated hydrocarbon content from less than one percent to around 20 percent.

On the Bradley lease which, as previously mentioned, has a very tight sand condition, the injectivity of input wells was doubled by the use of $CO_2$ in the water at comparable pressures. Laboratory core work has indicated that in the case of lime formations the injectivity is increased without materially changing porosity.

In his recent paper presented before the annual meeting of the Pennsylvania Grade Crude Oil Association Mr. Martin told how the use of carbonated water promotes the production of organic acids or their salts in the oil sand. "Not only were the organic acids found to be present in produced water, but evidences of their solvent action on the minerals in the sands were also found," he said. "The sand appeared to have been treated with organic acids because of the nature of the salts washed out of the sand. Among the salts that came out was a heavy production of barium sulfate and carbonate and it was difficult to explain otherwise inasmuch as water had been passing through this sand over many years prior to this time. During the test flood we produced large quantities—over a ton of barium sulfate and carbonate. Calculating it back, it is hard to believe that much barium sulfate and carbonate could be produced and put into solution, even though it has been transformed into barium bicarbonate; on the other hand it happens that barium formate, barium propionate, and some of the other organic salts are extremely soluble, as soluble as calcium chloride. This seemed to us evidence that organic acids had been formed, but in addition actual analysis was made of the organic acids in the produced water and they were proved to be present."

Summarizing his theory as to why $CO_2$ works to promote oil recovery he said:

"(1) Carbon dioxide reacts on some of the components of crude oil to form polar compounds. As one example, there are formed fatty acids and their salts. It is known that these compounds bring about a marked lowering of surface tension and also have effects on surface action in the sands.

"(2) Carbon dioxide is soluble both in oil and in water and thus penetrates to the surface of the sand grains whether the sand grain is water-wet or oil-wet.

"(3) Carbon dioxide has a property of materially limiting the adsorption on the sand of certain surface active agents, thus enhancing the usefulness of such adjuvants.

"(4) Carbon dioxide under high pressure has the property of forming loose compounds (or complexes) with some of the components of crude oil. These newly formed compounds are much lower in viscosity than the original crude. It can be said that they act as solvents for the crude oil.

"(5) Carbon dioxide promotes the solubility of natural gas in crude oil. It appears that natural gas is more readily soluble in the hydrocarbon-carbon dioxide compounds than in the crude oil. The two gases thus complement each other in their effect on the removal of the oil from the sand.

"(6) Increased injectivity is possibly brought about by several reactions: (a) Carbon dioxide decreases the pH of the oil sand adjacent to the injection well. This would limit bacterial growths that now tend to plug the injection area; (b) it also acts as a solvent for certain salts such as calcium carbonate whose crystals clog the passages between the sand grains; (c) it is thought possible that the presence of carbon dioxide tends to shrink some of the clay found in an oil sand and thus render a dirty sand more permeable."

Oil Recovery Chemicals (not to be confused with Oil Recovery Corp.) has been organized by Mr. Torrey and Allerton Cushman, Houston investment banker, to promote the use of surface active agents and corrosion and bacteria control chemicals in secondary recovery. Two products thus far announced are Ethmoid HT/60 to promote oil displacement and Arquad 2c to kill bacteria and check equipment corrosion resulting from hydrogen sulfide and salt water or from the use of mild

**James W. Martin originator of the Orco Process, has been engaged in carbon dioxide engineering for the past 25 years except during World War II when he was engineering manager on the $60 million Pine Bluff, Ark., Arsenal construction job. During World War I he also served the government, utilizing his previous experience in explosives work with du Pont and Tennessee Copper Co.**

**Paul D. Torrey, one of the organizers of Oil Recovery Chemicals, began his studies of secondary recovery methods in the Bradford and Allegany fields in 1927. He was sent to Houston as geologist for the Sloan and Zook Co. in 1935 to take charge of exploration work for that company in the Gulf Coastal region. He has been active in American Petroleum Institute committees dealing with production practice and secondary recovery.**

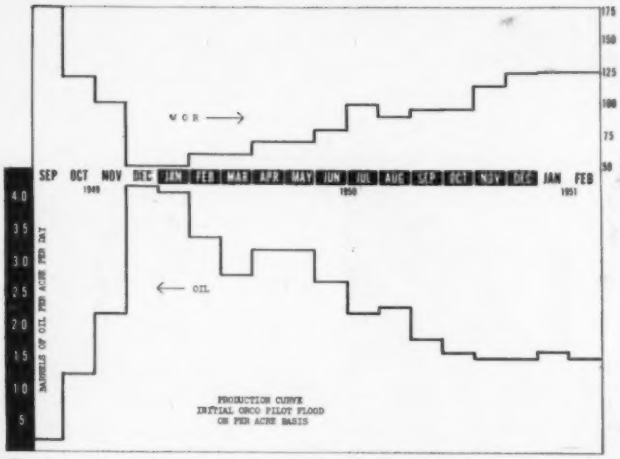
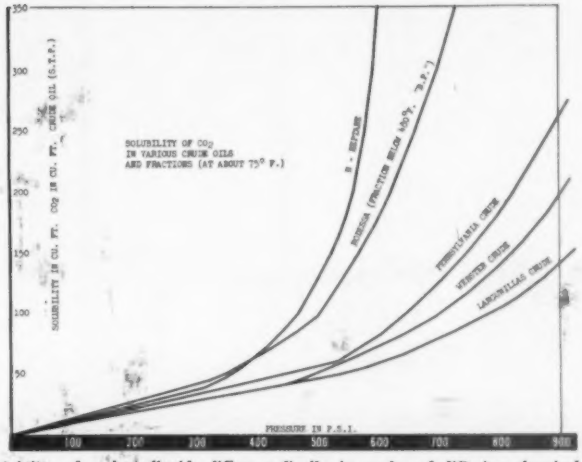



**Chart showing production of oil and water-oil ratio of initial Orco pilot flood on the Bradley property.**


SOLUBILITY OF CO2
IN VARIOUS CRUDE OILS
AND FRACTIONS (AT ABOUT 75° F.)
SOLUBILITY IN CU. FT. CO2 IN CU. FT. CRUDE OIL (S.T.P.)
PRESSURE IN P.S.I.
R - REFORM
RODESSA (FRACTION BELOW 400°F., 75 P.I.)
PENNSYLVANIA CRUDE
VENEZUELAN CRUDE
LAGUNILLAS CRUDE

**Solubility of carbon dioxide differs radically in crudes of differing chemical composition.**

acids used in flood water.

In a recent talk[1] before the North Texas Section of the petroleum division of the American Institute of Mining and Metallurgical Engineers, Mr. Torrey revealed the direction of his own research activity into chemical means of increasing production and described field tests under way in both California and Pennsylvania fields.

Mr. Torrey told the AIMME that Bradford field tests have shown that use of a non-ionic, N-substituted fatty acid amide will increase relative permeability of tight sands and thus increase water injection at unchanged pressures. The treatment may minimize or eliminate shooting of input wells and thus permit the setting of packers in the borehole to prevent water by-passing through fractured or highly porous pay streaks.

Previous attempts to use detergents in oil wells to loosen the bond between oil and reservoir surfaces have been unsatisfactory because of the quantities required. The synthetic detergents have been quickly absorbed by the oil sand within a short distance of the borehole and thus have lost their effectiveness. Cost of adding enough detergents to the input water was too great to be economic.

Ethmoid HT/60 is reported to have the tendency to collect at the contact between a liquid and a solid or between a liquid and a gas when used in quantities as low as five ppm in flood water. More important, the chemical is not adsorbed by sand particles but continues to reduce the surface tension of the water as the front of the flood advances through the reservoir.

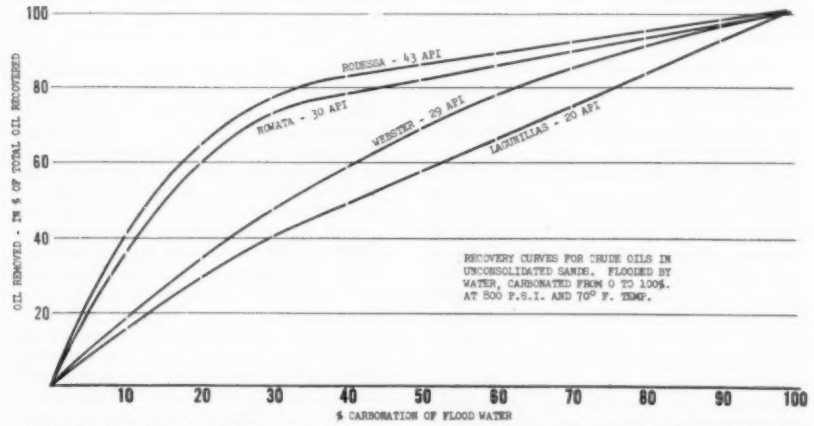
Laboratory tests have shown that an acidic water solution will prevent the flocculation and swelling of clay minerals when they come in contact with water. The acidic water thus permits freer passage of oil and water through the reservoir from input to producing well. Unfortunately the use of such water tends to create corrosion in subsurface equipment and to prevent this Mr. Torrey has developed a number of water soluble quaternary ammonium salts as inhibitors. A field test of Arquad 2C is to be begun shortly in Oklahoma in a field where clay hydration has prevented successful water floods.

Recent laboratory research on oil recovery by water flooding California reservoirs has shown remarkable reduction in residual oil content as a result of the addition of very small quantities of non-ionic ethylene oxide condensation products to the injected water, Mr. Torrey reported. The results obtained from these laboratory tests have been so promising that an experimental field test was commenced in April in California and another test is contemplated. Extensive laboratory work is being planned for further study of the reaction of reservoir rocks from other important oil-producing regions to this form of treatment.

Mr. Torrey pointed out that many oil wells, in both primary and secondary recovery operations, cannot be produced profitably because of excessive production of water, even though considerable sections of the reservoir which possess lower average permeability have not been depleted of their oil content. The possibilities for creation of water repellent surfaces in oil reservoir rocks in order to retard or stop water encroachment have been recognized for many years, and various substances cause a temporary change in the nature of the surface, he said. The temporary results have thus far been a bar to economic use.

Recently, it has been discovered that certain complex nitrogeneous compounds will produce hydrophobic surfaces on oil reservoir rocks and will maintain this property in the laboratory for a period of over nine months. The sand samples that have been treated with this reagent have been washed repeatedly with both fresh and saline water with no apparent loss in hydrophobic tendencies. Furthermore, no resistance to the flow of oil has developed. Laboratory experiments in the use of this and other similar reagents will be continued at the new Austin, Texas, laboratories.

The clues which have been given to eager oil industry research organizations by the work of Mr. Martin, Mr. Earlougher, Mr. Torrey and their associates undoubtedly will initiate a vast amount of new work. The chemical engineers appear to have their foot in the door and may be expected to create a permanent place for themselves in the job of adding a few more billion barrels to recoverable reserves of oil from the known quantities not now economically producible.


OIL REMOVED - IN % OF TOTAL OIL RECOVERED
RODESSA - 43 API
ROMATA - 30 API
WEBSTER - 29 API
LAGUNILLAS - 20 API
RECOVERY CURVES FOR CRUDE OILS IN
UNCONSOLIDATED SANDS. FLOODED BY
WATER, CARBONATED FROM 0 TO 100%.
AT 800 P.S.I. AND 70° F. TEMP.
% CARBONATION OF FLOOD WATER

**Crudes with a high $CO_2$ solubility factor are recoved more readily with lower carbonation percentages.**

[1] Journal of Petroleum Technology, June, 1951.

Atmospheric distillation unit at Normandy refinery of Compagnie Francaise de Raffinage.

# French Refining Capacity Meets National Requirements

By Bernard Pene*

THE purpose of the present study is to give a brief resume of the activities of the French refineries in the course of the past year and a summary report on the works and new installations completed or which will be finished shortly.

Increased production characterized the activities of the refineries in 1950. Crude runs during the year amounted to 106,157,000 barrels, a gain of 27 percent over 1949.

The same progression has continued during the early months of 1951. From June 1, 1950 to May 31, 1951 the refineries treated 117,200,000 barrels of crude. A noteworthy increase took place in domestic crude production which rose to 1,878,000 barrels against 689,000 barrels in the preceding year. Of this total 1,021,000 barrels was produced by the Lacq field.

Exploration is being continued with encouraging prospects and there is reasonable hope that both in France proper and the overseas territories production will increase in the years to come.

Among the refiners the share of the Compagnie Francaise des Petroles in the production of Iraq was 11,717,000 barrels, an increase of 66.4 percent over the preceding 12 months. Crude oil imports as a whole increased to 115,540,000 barrels. Sixteen percent of this was paid for in francs (which corresponds to the French share of Iraq production and payments for Near East oil as agreed with the American groups); 36 percent was paid for in dollars, amounting to $64,422,000, for purchases made by Standard Francaise des Petroles, Socony Vacuum Francaise, the Raffineries de Petrole de la Gironde, subsidiaries of the American companies, and by the companies which have no foreign connections: Compagnie Francaise de Raffinage and Raffineries de Petrole de l'Atlantique; 47 percent was paid in pounds to the equivalent of $92,722,000 for covering the needs of companies with British participation: Societe de Petrole B.P. and Compagnie de Raffinage Shell Berre.

As in the preceding year, nearly all the purchases payable in dollars were made with Marshall Plan funds. From the first of April 1950 to April 1, 1951, the ECA financed a total of $74,588,000 worth of crude oil, $13,147,000 worth of finished products and $28,-

* Formerly Captain in the French Naval Service from which he resigned to devote his attention to the petroleum industry and particularly to the subject of refining.

330,000 for freight, totaling $116,065,000.

It may be noted that, as regards the origin of the imported oil, there was a natural change that paralleled the trend of importations into the United States; 86.9 percent of the imported oil came from the Middle East, against 81.1 percent in the preceding year.

Efforts begun in 1949 to reduce dollar imports were continued. Payment for Middle East crude supplied by the American companies was 75 percent in dollars and 25 percent in francs. In the case of Socony Vacuum the percentages were 65 percent in dollars and 35 percent in francs.

It is considered desirable that this practice should continue to be followed, but its extension is subordinated to the possibilities that open up for the sellers to make a renewed use of their funds in francs on the French industrial market. This question is now receiving the attention of the American oil companies, the government and the French industrialists.

Except for small tonnages of special products, the refineries have been able to satisfy the whole national demand, thus attaining their essential objective.

Imports of finished products have been limited to 100/130-octane aviation gasoline, to certain kinds of lubricants not yet produced by the French refineries, and to small tonnages of high-octane motor fuel, paraffin and petroleum coke.

During the past 12 months the products refined by the French works went to the following destinations:

| | |
|---|---|
| France, including French bunkers | 75% |
| Overseas territories | 9% |
| Special treatments and exports | 16% |

Exports consisted mostly of excess gas oil and seasonal quantities of fuel oil. The special treatments correspond to the indispensable margin between the overall capacities of the refineries and the capacity needed to satisfy consumer demand which cannot always be foreseen exactly.

Consumption has been affected by several factors. Especially in the latter part of last summer, the decision of the government to blend a certain amount of alcohol in gasoline had a notable effect. Thus the motorists have had at their disposal a "binary fuel" (mixture of alcohol and gasoline) with an octane number of 70 (motor method) and two "super fuels," with octane number of at least 74 (motor method). One is a pure gasoline and the other a "ternary mixture" of alcohol, benzene and gasoline.

The binary fuel, very unpopular with motorists, was suppressed in December as the government found an opportunity to export the excess of alcohol to the United States. At present the fuels in consumption are an ordinary gasoline of 70 octane number (motor method) and the super fuels, consisting of pure gasoline or a ternary mixture of 80 and 86 octane (research method).

In spite of these difficulties and the continued increase of internal taxes, the year 1950, which was the first year of complete liberty of distribution since the war, was marked on the whole by a remarkable development in the use of fuels. The increase in relation to 1949 was 30 percent and for the first time the consumption level of 1938 was reached. As regards the industrial fuels, the advance was smaller, about 10 percent, due to the nearly stationary demands of the railroads, the electrical power establishments and the bunker market.

In the present state of refinery equipment the fabrication percentages of the principal products have been as follows: 21.5 percent gasoline, 25.6 percent gas oil and various distillates, and 39 percent fuel oils.

When the new catalytic cracking units contemplated by several refineries come into action these proportions will be altered in the sense of a better adaptation of production to the needs of the country, particularly in an increase in the ratio of gasoline to fuel oil.

As regards equipment, it will be recalled that the first ECA dollars allotted for reconstruction and modernization of refineries were unblocked in November 1949. The projects approved by the ECA in the second half of 1949 related especially to the production of lubricants, to certain kinds of distillation units and various apparatus for general services; the principal projects submitted to the ECA in 1950 and 1951 have related to catalytic cracking units.

At the present time a large portion of ECA dollar credits allotted for the equipment program have been unblocked and the ECA will undoubtedly approve the projects submitted at the beginning of 1951. It may be recalled that the total equipment expense of the refineries within the long term program amount to about $200 million and that only 12 percent is payable in dollars. Engineering costs account for 70 percent of the dollar expense.

It may be mentioned, finally, that a very important portion of the ECA funds has been or will be used for improving the quality and refinery yields of engine fuels and lubricants.

In the matter of fabrication units, the year 1950-1951 was marked by the putting into service of four distillation units, one unit for propane deasphalting, one unit of solvent deparaffining, and various installations for gasoline refining.

At the Normandie refinery of Compagnie Francaise de Raffinage, a new unit for atmospheric and vacuum distillation with a capacity of 20,000 B/D was put into service in the latter part of 1950. At the end of the year, a "solutize" installation for refining gasoline was completed. Among the principal works at present under way are units for deasphalting by propane, lubricant refining by furfural, dewaxing by methyl ethyl ketone and for clay treatment. These works will be finished by the beginning of 1952.

The company is proceeding with various aspects of its utility services, the development of laboratories and extension of housing. It is also putting in an installation for recovery of cracking and reforming gases. When these units are completed the Normandie refinery will have, in 1952-1953, a nominal capacity of about 52,000 B/D.

In August last, a new distillation unit with a capacity of 20,000 B/D went into operation at the Provence refinery. Since December the gasolines have been refined by the "solutizer" process. The works now in progress include a unit for fractionating propylene (to be finished by the middle of 1952), means for conditioning and shipping liquefied gases and bitumens and storage tanks (storage capacity for crude oil at the port of l'Avera has recently been increased to 130,000 cubic meters—820,000 barrels).

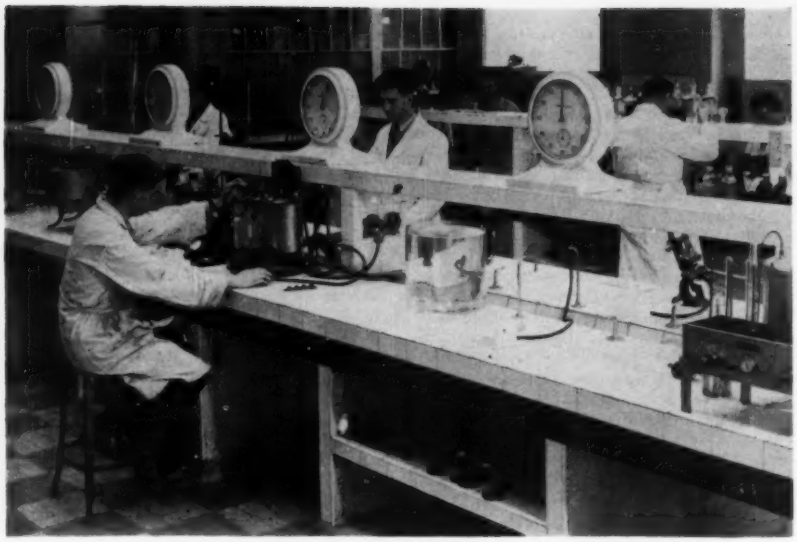
The treating capacity of the refinery La Mede is of the order of 47,000 B/D.

At the Berre refinery of Compagnie de Raffinage Shell Berre the new 43,000 B/D topping unit authorized by ECA was put on stream in March 1951 and as a result the capacity of the refinery has been increased to about 57,000 B/D. A gasoline sweetening unit was put to use during the first half of 1951.

Among works under way are a new 9,000 B/D thermal reforming unit which will be finished in the latter part of 1951, extension of the tank farms for crude oil and finished products, and various utilities including a power station, water system and trackage. A vacuum distillation unit is under consideration. The ECA has under examination a proj-

Naphtha rerun columns at Dunkerque refinery of Ste Generale des Huiles de Petrole.

New topping unit put in service in March 1951 by Compagnie de Raffinage Shell-Berre at Berre.



Control laboratory at the Port Jerome refinery of Standard Francaise des Petroles.

ect for a new 10,000 B/D catalytic cracking unit to be finished in 1953.

At the Petit-Couronne refinery the crude oil distillation unit was enlarged by addition of a new furnace. When the cracking unit that for some years has been used for topping resumes its original function the refinery will be able to treat about 38,000 B/D. The works now in course include enlargement of the Edeleanu unit, increase of thermal reforming capacity and construction of storage, utility services and housing. There is also under construction a pipe line for bringing crude oil from Le Havre to the Petit-Couronne refinery. An adjacent factory for the preparation of detergents will soon begin operations.

For the past twelve months the Pauillac refinery which specializes in the treatment of asphaltic crudes has been processing crude from Lacq, in Aquitaine. Its distilling capacity is now 7,000 B/D. A new wharf was opened for shipping in the latter part of 1950, and a second wharf for tankers is now under way.

The new refinery of Societe General des Huiles de Petrole B.P. at Dunkerque, the 7,000 B/D topping unit of which went on stream in February last, will be ready for complete service by the end of 1951 or beginning of 1952.

**TABLE I**

**Period of June 1, 1950—May 31, 1951**
**Crude Oil Delivered to the Refineries**

| Middle East | Barrels | Percent |
|---|---|---|
| French participation by the I.P.C. | 11,717,000 | 10. |
| Other origins | 90,221,200 | 76.9 |
| **Western Hemisphere** | | |
| U.S.A. | 511,500 | .4 |
| Venezuela | 12,942,300 | 11. |
| Other origins | 471,700 | .4 |
| **National Production** | 1,506,000 | 1.3 |
| | 117,369,700 | 100. |

The works of the Genie Civil[1] were begun in 1948 preparatory to the installation of the principal units which are well on the way to completion. The refinery will then have two units for crude distillation (one of 7,500 B/D and one atmospheric vacuum unit of 26,000 B/D) a thermal reforming unit, a unit for deasphalting with propane, a unit for refining with furfural, and an MEK deparaffining unit.

The principal work done at the l'Avera refinery has been directed toward various units and utility services and the building of new storage tanks. The distilling capacity of the refinery is now about 36,000 B/D. The company has under study a project for a unit to improve the quality and especially the octane rating of its gasoline. Adjoining the refinery the Societe Naphtachimie is building a factory for making glycols, acetone and various solvents.

The Port-Jerome refinery of Standard Francaise des Petroles' construction of new propane deasphalting and deparaffining units is proceeding; this project was authorized by ECA in 1949. These units are scheduled to go into operation about the end of 1951. Besides this project the company's program for fiscal 1951-1952 includes the following works: a second crude oil pipe line between Le Havre and Port Jerome, development of laboratories, modernization and extension of the power plant. A 10,000 B/D catalytic cracking unit, which was authorized in June, 1950, will go on stream some time in 1953. The refinery's present capacity is about 41,000 B/D.

At the Donges plant of Raffineries Francaises de Petroles de l'Atlantique a new distillation unit has just been put into operation, and a gasoline desulfuring unit was put in operation in the latter part of 1950. Among the principal works now in progress are extension of the utilities services, construction of a new wharf and a new unit for the acid-clay refining of lubricating oils which will be finished in 1952. ECA is examining a project for a 6,000 B/D catalytic cracking unit which probably will be finished in 1953. The company is also considering various projects for the polymerization and transformation of refinery gases.

Works in progress during 1950-1951 by Raffinerie de Petrole de la Gironde (Ambes) consist mostly of improvements of existing units for increasing topping and reforming capacities. The Ambes plant was restored to service in February 1950. Its present capacity is 18,000 B/D.

A new crude distilling unit was put into service in August last by Societe Pechelbronn S.A.E.M. (Merkwiller refinery). Various works of improvement and modernization, mostly concerning utilities, have since been completed. The company has under consideration a project for deparaffining with dichloroethane which is scheduled for completion in 1952.

Socony Vacuum Francaise at its Notre-Dame-de-Gravenchon refinery is installing new units for fabrication of lubricants, authorized by ECA in the summer of 1949. A new unit for propane deasphalting and a unit for MEK deparaffining are about ready. The utilities services are being extended and modernized. Various projects for extension of storage and shipping facilities will be completed this year. Construction of an installation for recovery of butane and refinery gases is under consideration. Installation for improving the octane ratings of gasoline are also contemplated. The present capacity of the refinery is 15,000 B/D.

Construction of a 10,000 B/D catalytic cracking unit at Raffinerie de Frontignan was begun in 1950 and is scheduled for operation in the fall of 1951. Work on a new power house is nearing completion. Modernization and extension of shipping facilities, storage tanks, shops, laboratories and housing are also under way. The capacity of the refinery is now 20,000 B/D.

To complete this brief survey of the activities of French refineries, reference may be made to the very important work now in progress for improving the oil port of l'Avera that serves the three Etang de Berre refineries, which will make this port accessible to tankers drawing 36 feet.

Mention should also be made of the construction of a ten-inch pipe line for taking white products fabricated in the refineries of the lower Seine district to the region of Paris, which will go into service in the winter of 1952-1953.

**TABLE II**

**Period of June 1, 1950—May 31, 1951**
**Shipments from Refinery**

| | | |
|---|---|---|
| Propane | 13,700 | metric tons |
| Butane | 127,900 | metric tons |
| Gasolines | 29,865,000 | barrels |
| White spirit | 532,000 | barrels |
| Turbine oils | 281,000 | barrels |
| Illuminating oils | 2,330,000 | barrels |
| Gas oil | 27,568,000 | barrels |
| Fuels | 40,719,000 | barrels |
| Lubricants | 2,180,000 | barrels |
| Bitumens | 670,331 | metric tons |
| Petrolatum | 1,796 | metric tons |
| Parraffin | 9,509 | metric tons |
| Paraffin distillates and various by-products | 418,000 | barrels |

[1] Roads, foundations, water supply, drainage, trackage, etc.

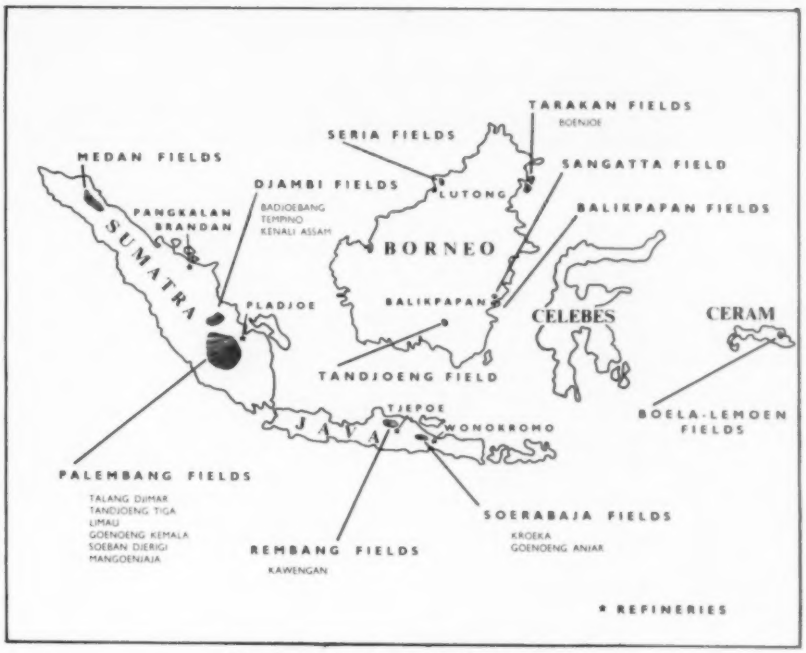
# Far Eastern Fields Make Strong Recovery From Wartime Setback

ALTHOUGH the Far East never has ranked among the great oil producing regions of the world, in comparison for example with the United States, the Caribbean region or the Middle East, certain factors have given it an importance beyond the mere volume of its output. One of these is its location, easily accessible to important markets in Oceania and the populous countries bordering the Pacific. Another is the high quality of some of its oil and the enterprise of the companies developing its liquid resources.

The term itself is rather loosely applied. To most persons it probably connotes the islands now forming Indonesia together with British Borneo and New Guinea and this is the geographical group to which it will be applied in this article. Sometimes India and Burma are referred to as part of the Far East though it would be more accurate to look upon them as belonging to the Middle East. In a comprehensive view Japan and Sakhalin should be included though neither is of particular consequence in the world picture at present.

The section of the oil industry located in the Far East has experienced many vicissitudes. Many of its fields and plants were out of operation during World War II. In some places wells were plugged or blown up and buildings put to the torch ahead of Japanese invasion. Later on locations where the invaders had got fields or refineries into partial operation were bombed by Allied planes. Finally, when the Japanese were forced to withdraw they attempted to complete demolition before leaving.

When the owners of the buffeted properties returned to claim them after the enemy was expelled, which in the typical case of British Borneo was in June 1945, they found the fields and plants in a seemingly hopeless condition. G. O. Higgins, general manager of the British Malayan Petroleum Co. gave a description of the scene in the following terms; "When we first went in a pall of thick black smoke from the burning oil hung over a vast area, turning the tropical day into a gloomy twilight. The roar of the gas escaping from the wells was deafening, and it was in this inferno that the Australian Army, with the help of Shell technicians, had to tackle the stupendous task of extinguishing 37 separate oil-well fires. By September of that year, three months later, the last well was brought under control." As Mr. Higgins added, "We then had a big task ahead of us to make good the devastation that had been caused." This task, of course, was complicated by the complete lack of supplies and the inaccessibility of the area. Nevertheless, the work of rehabilitation went on. Oil wells were brought back into production, new wells were drilled and pipe lines were laid. In March 1946, the first cargo of crude was shipped out and later in that year the refinery at Lutong which had been badly damaged was brought into partial operation pending the erection of a new plant brought out from the United States. Production from the Seria field has increased rapidly. Together with the small output of the older Miri field in Sarawak, it has risen from 2,000 barrels daily in 1947 to nearly 90,000 in the latter part of 1950, making Borneo the largest oil producing district within the British Commonwealth.



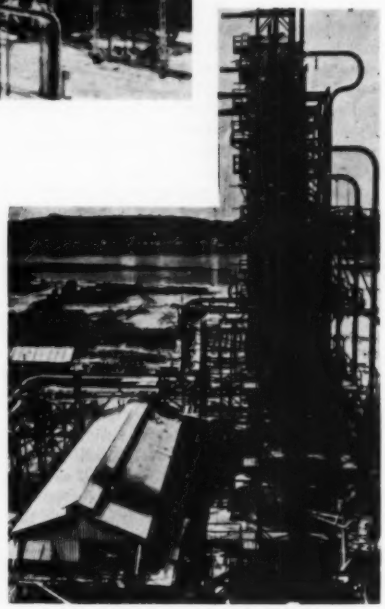

**Map showing location of oil fields and refineries.**

The Seria field, located in the native state of Brunei, extends along the shore for several miles with a depth of about a mile inland. By directional drilling and from jetties built above the water some of its oil is obtained from beneath the waters of the China Sea. This offshore drilling is being increased and is considered to have possibilities of materially extending the field. In the past two years the British Malayan Oil Co., which is a member of the Royal Dutch-Shell group, has been engaged in constructing a modern town to house its growing staff and workers. This community of several hundred structures includes separate houses for families, blocks for unmarried workers, schools, hospital and recreation facilities to provide comfortable living for the company's employees.

Conditions more or less similar to those encountered in British Borneo were found in other fields of the Far East. In that portion of Borneo formerly included in Netherlands India but now a part of Indonesia repair work has not been completed in all fields but new exploratory tests have been made. Drilling in the Tandjoeng field in the southeastern part of the island was resumed in 1947. Since then exploratory wells have been put down on the island of Tarakan where a deep test was drilled to 9,452 feet on Tandju, northeast of Tarakan, and at Sangatta south of Louise. The existence of oil in these loca-

New distillation unit at Balik Papan refinery of Bataafsche Petroleum Maatschappij (Royal Dutch - Shell Group).

Atmospheric unit No. 1 at Balik Papan. All photographs with this article are reproduced through courtesy of Shell photo library.



tions was demonstrated and further exploration is being conducted to determine the possibilities of development.

The refinery at Balik Papan on the eastern shore of the island which was in ruins at the time of the Japanese evacuation was brought back into partial operation in 1946 by the erection of a crude distillation unit put together by using equipment salvaged from the old refinery. By the end of that year a second unit built in the same way had been completed, giving the refinery a distillation capacity of 8,000 barrels daily. As production increased further work on the refinery was carried on. By the end of 1949 a vacuum unit and a wax plant had been added. In March 1950 capacity was increased by bringing into operation a completely new distillation unit and at the close of 1950 crude capacity was up to 27,000 barrels daily as compared with a pre-war figure of 48,000. Additions under way include another large distillation unit, plants for manufacture of asphalt and lubricants, an Edeleanu kerosine treating unit and an Ethyl blending plant.

In southern Sumatra the clearing of fields and reconstruction of refineries at Pladjoe and Soengi Gerond has advanced to a point where production exceeds its prewar level. The fields formerly serving these refineries are in operation again and development work is under way at Tandjong, Tiga, Liman, Gujung, Kemala and other fields. Additions to refining equipment at Pladjoe include two cracking units, a redistillation unit and other treating installations. An atmospheric distillation unit designed by Alco Products and an Edeleanu gasoline plant are among recent additions which have raised the crude treating capacity to 74,000 barrels daily as compared with 50,000 pre-war. In central Sumatra development work by Nederlandsche Pacific Petroleum Maatschappij has uncovered deposits of high grade oil but in the northern part of the island the continuance of disturbed conditions has made it impossible to reoccupy fields or restore operation of the Pangkalan Brandan plant.

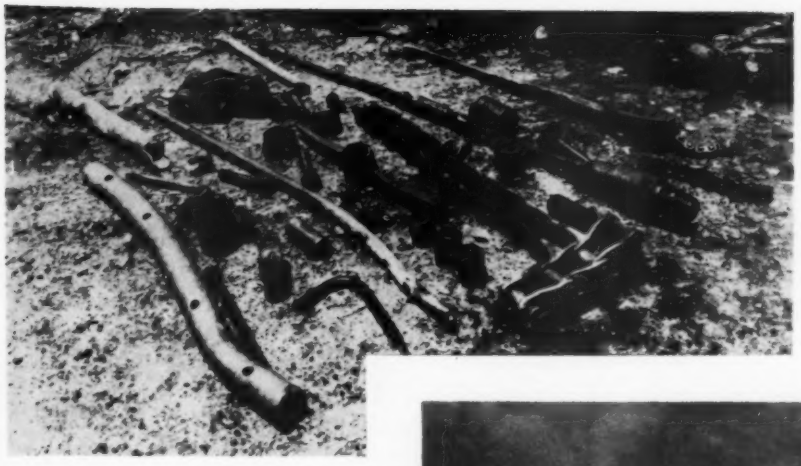
Delays in reoccupying some of the Java fields have prevented rehabilitation from making as rapid progress as in some other parts of Indonesia. The refinery at Worokromo was left in reasonably good condition by the Japanese except that the distillation unit had been moved to a new location at Bandul, about a mile distant. It was possible to bring the plant into operation late in 1946. It now operates on crude from Kruka and Klamono in Dutch New Guinea with a throughput of about 2,000 barrels daily as compared with 2,300 prewar.

At Tjepu, Java, the refinery did not become accessible until early 1949 and was found in a badly damaged state. It is planned to rebuild the distillation unit and the Ethyl blending installation with needed auxiliaries to manufacture products for local consumption.

Production in the small Kruka field was recommenced in 1946. Some exploratory tests have been made south of Surabaya but without commercial results though drilling is still in progress in Gunung Anjar. The Kewengen field west of Surabaya was not re-entered until 1949. After intensive work of rehabilitation, drilling and production were resumed in 1950, the crude being shipped to Balik Papan for refining. In the small fields of Ceram all surface facilities were lost during Allied bombing and these have not been brought back into operation.

During the time of Japanese control little or no attention was paid to field conditions or to the proper maintenance of wells. As a result bottom pressure drop, edgewater encroachment and gas cap expansion in the main reservoirs became very marked and irregular. Much attention has been given to correcting these conditions and some improvement has taken place. It is not to be expected however that all the damage done can be remedied.

In spite of all the obstacles encountered Indonesian production has made remarkable

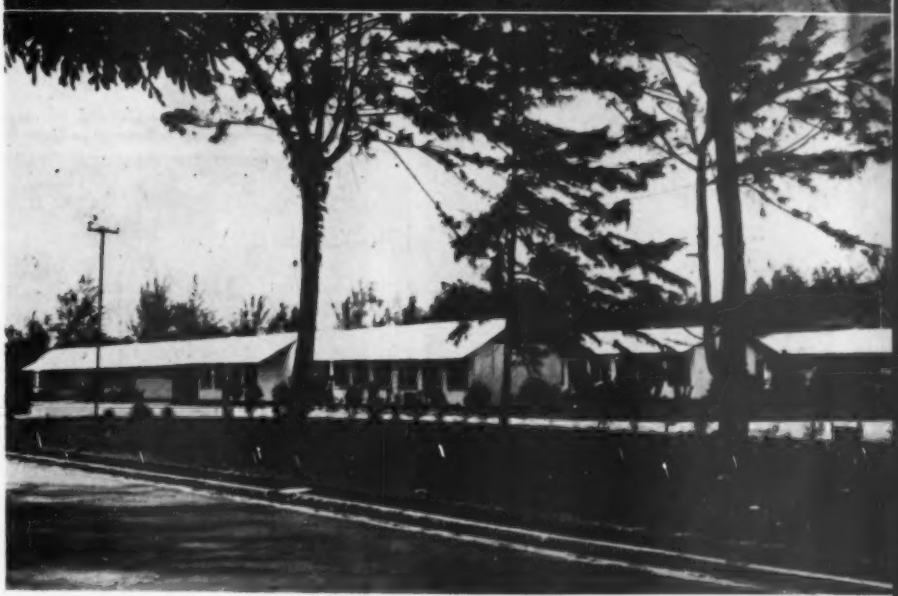


Some examples of scrap brought to the surface.

Loading jetty at Balik Papan refinery.

Bent tubing on pipe rack.

progress in the past two years and is now back to 80 percent of its best prewar output. Geological exploration, resumed in Borneo, Java and Sumatra, is progressing favorably and gives promise of increased production for the future.



New housing built since the war for Balik Papan refinery employees.

# ARAMCO Wildcat In Persian Gulf Finds Cretaceous Production

Sixty-foot drilling mast used for marine structure exploratory work in the Persian gulf. Aramco Photo.

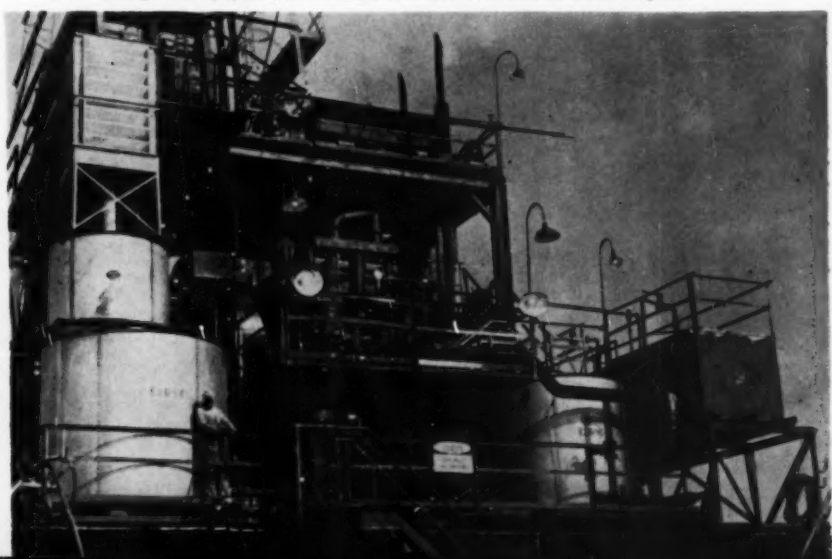
Two barges used in connection with the structure drilling rig. At right is barge carrying living quarters. Barge at left carries working and operating quarters. Rig is suspended from this barge when moving to a new location.

General view of the Safaniya offshore drilling rig with which the successful wildcat was drilled. Photo courtesy Bechtel International.

ARABIAN American Oil Co. has discovered oil in commercial quantities in its first offshore wildcat drilled in the Persian Gulf. The new field is the second to be discovered this year and brings to nine the number of fields in Saudi Arabia.

The new discovery well was drilled about 12,000 feet offshore near Ras Safaniya. It is the northernmost field in Saudi Arabia lying near the northern border of the country about 20 miles from the Kuwait neutral zone. It is about 270 airline miles north of the Haradh

Detail indicating how marine platform structure was minimized by installing machinery and auxiliary tankage and equipment on three different levels. Bechtel International photo.



field, the southernmost producing area in Saudi Arabia, and lies on the same general trend as other fields to the south.

Unlike other Saudi Arabian fields the producing zone in the new well is probably Cretaceous. Cores from the pay and the analysis of oil recovered during testing indicate that the field is of the same geological age as the Burgan field in Kuwait and the Bahrein field. Elsewhere in Saudi Arabia, Cretaceous rocks have been eroded away except for isolated surface showings and wells are providing from the Jurassic.

Oil recovered in the drill-stem test is somewhat similar to that produced on Bahrein and in Kuwait. Apparently hydrogen sulfide is absent from the oil.

Arabian American has not completed the well in the Cretaceous but is drilling ahead to determine whether there are deeper producing zones. Currently the well has been drilled to about 7,000 feet or roughly 2,000 feet below the top of the pay zone.

Due to the fear of mechanical difficulties which often complicate testing operations in Saudi Arabia the discovery was not given a thorough test. It was thought better to continue the drilling rather than to risk sanding up the hole above packers since it was desired to explore lower horizons. Analysis of cores recovered and the drill-stem test have been conclusive enough to warrant the company in adopting a program for further drilling.

Aramco geologists believe that the Safaniya field will be partly onshore and partly offshore. No. 2 well is being drilled on the peninsula about 2½ miles south of the discovery. Well No. 3 will be drilled offshore about 10,000 feet west of No. 1 and No. 4 will be drilled 8,000 feet east of No. 2. Subsequent drilling program will not be determined until lower horizons are tested and a better idea is obtained of the extent of the pay zone already discovered.

Geological and geophysical exploration work along the shore of the Persian Gulf in the discovery area was carried on for more than a year prior to staking the location for the test well. Gravimetric studies, marine seismograph surveys and detailed core drilling work was done. Late in 1949 a marine seismograph party began work in the entire coastal area from Ras Tanura to the northern border of the country. Preliminary work was followed by detailed studies of the most promising area.

For the core drilling operations a technique developed by Bahrein Petroleum Co. in its work adjacent to the island was adopted by Aramco explorers. The equipment, known as the Witherspoon bridge, consisted essentially of two barges and a portable drilling platform capable of operating offshore at water depths up to 18 feet. The drilling platform is a pre-fabricated steel structure with two 40-foot U-shaped legs which are lowered to the bottom. The legs are equipped with sharp spuds which grip the bottom and keep the platform firmly in place.

The drilling platform is transported to the location by two barges. At location, after lowering to bottom and leveling, a 60-foot mast is skidded from one of the barges to the platform and drilling commences. When a hole is completed the mast is returned to one of the barges, the platform is lifted by a barge with the aid of water ballast displacement plus the lifting force of high tide. It then goes to the next location.

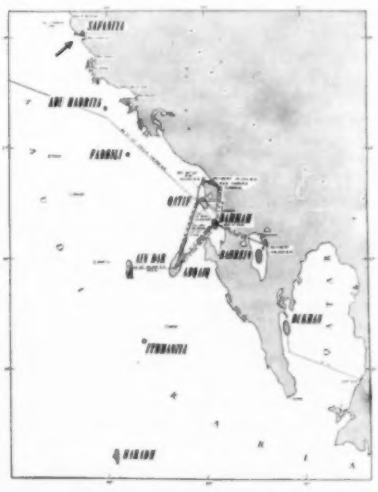
Marine drilling of commercial wells has been conducted at various points for a number of years. The Lake Maracaibo development with hundreds of wells drilled from caisson-mounted platforms has been in progress since 1932. The more spectacular offshore drilling in the Gulf of Mexico where wind and wave create special hazards is a more recent development. In the Persian Gulf windstorms are not as great a problem as in the Gulf of Mexico and, although the Persian Gulf waters are often choppy in a 40-mile wind, it was deemed satisfactory to have the Sanfaniya platform 25 feet above low tide and the rig designed to withstand an 80-mile gale.

The floor of the Persian Gulf is generally hard coral with little or no silt or sand overburden. Result is that neither wooden piles nor caissons may be employed in building a drilling platform—or shore-based piers either, for that matter. The Safaniya platform is supported by ninety-three 14-inch steel pipes weighing 73 pounds per foot. Piles were driven by the same barge used by Bechtel International in constructing the Damman port for the Saudi Arabian government in 1950.

Because of the hard floor of the Gulf it was difficult to get penetration even with steel piles. The builders drove 38 of the piles diagonally and 55 vertically. This provided a sturdy foundation for the 300-ton normal structure load plus the anticipated maximum additional pipe load of 500 tons, as well as withstanding lateral wind and wave forces.

As indicated in the accompanying photograph the rig was built on three levels to minimize over-all platform cost. Lowest deck is 25 feet above water, the second deck 40 feet, and the generator and tool house deck is 53 feet above water level. Drilling rig is diesel-driven.

Steel for the platform was fabricated partly at Ras el Misha'ab, the near-by camp at which equipment for the Trans Arabian Pipe Line was assembled, and partly at the refinery camp at Ras Tanura some 120 miles to the south. Fabricated sections were barged to the well site.




**Map showing location of Safaniya wildcat near the northern border of Saudi Arabia. Most recent previous discovery was at Ithmaniya about midway between Abqaiq and Haradh in the south.**

Pile driving operations were begun on October 25, 1950, and drilling machinery was in place 55 days later. Bechtel International erected the main structure and aided the Aramco drilling department in building the derrick and installing drilling equipment. Aramco began drilling on January 6, 1951.

Drillers in the Middle East assert that they can get into more trouble in operations there than almost anywhere in the United States. The cavernous lime formations cause frequent loss of circulation and tend to develop crooked holes. The water bearing formations often are under high pressures. Given high pressure water in a cavernous formation in which circulation cannot be maintained and it is clear that the driller has his hands full to keep pressures balanced. To do this he uses a lot of mud. Where possible the drillers attempt to let the cuttings accumulate in the caverns but this can cause trouble too, resulting sometimes in stuck pipe.

Casing programs on Saudi Arabian wells are complex, because of the necessity of protecting potable water supplies and shutting off zones of lost circulation.

For the second offshore well Aramco will use a diesel-electric rig built in Louisiana in 1948 for Creole Petroleum Corporation and first used in Lake Maracaibo. The drilling barge was towed from New Orleans to Venezuela and has recently been towed across the Atlantic on an 11,000-mile trip ending in the Persian Gulf.

Creole drilling barge No. 2142 was dubbed the "Queen Mary" when it first appeared in Venezuela because of its large size, 72 by 182 feet with a 9-foot draft. It is equipped with a 5-ton Whirley crane for handling heavy equipment, fuel tanks with a 30-day supply, an evaporator to provide pure engine and drinking water and living quarters for the crew. Electric power for the rig is generated by diesel driven Westinghouse generators. The barge as originally designed makes it possible to drill from a platform of minimum size, thus reducing the cost of marine operations. On Lake Maracaibo a 24-foot drilling platform was all that was required since pipe was carried on the forward top deck of the barge.

The barge was designed by Creole and Westinghouse engineers to maintain continuous power to the rig even in rough weather. It is equipped with special ballast tanks and pumps to maintain trim and cable hawsers permit pulling 30 feet away from the drilling platform in rough seas without interruption.

Use of the "Queen Mary" will minimize the travel for crew members because of the crew quarters. For the first well drilled the crew traveled by launch to shore and thence by car to the pipe line camp at Ras El Misha'ab, the combined distance amounting to a total of about ten miles.

The rig is one of the heavier currently manufactured and is capable of drilling formations to maximum depths. In the region of the Persian Gulf the sedimentary layer is of very great depth so there will be plenty of room for digging within the rig's capabilities.

# Steel is Critical Factor in PAD Program

By Joseph B. Huttlinger

WASHINGTON

ONE of the few things that may be said about the current petroleum supply picture, as far as America is concerned, is this: barring an all out war, or major, unforeseen disaster, consumer rationing of gasoline and fuel oil is unlikely in the months ahead. Such assurance seems to be needed because anxious consumers continue to make inquiries.

This estimate takes into account the two bellwether factors, Iran and Korea. Government economists have felt that a complete shutdown of the huge Abadan refinery with its 550,000-barrel daily output would bring a demand upon the United States for up to 250,000 barrels daily, mostly of products. This problem is being handled by the committees recently set up on both sides of the Atlantic and it is believed that it can be solved without serious hardship on any one segment of the industry. As for Korea, the shooting could go on or stop, and it would make no change in the current estimate. An end to the Korean war could save up to 100,000 barrels daily, one-fourth of current military requirements. The rest of the military demand would continue to be used for rearmament and training.

Warnings of possible shortage are still voiced, however, and have been all year. Mostly, they have come from defense officials, with one eye alert to the threat of war. At times, they have been ignored, partly because gasoline price wars flitted along the East Coast during the spring and early summer. For months, the office of Price Stabilization has urged drafting of a standby rationing plan just in case of war. It also raised the price ceiling on residual oil in an overt move to encourage consumers to shift to coal, and thus save the oil. Similarly Interior Secretary Chapman, who is also Petroleum Administrator for Defense, pleading for more steel, has warned of rationing unless "much more" steel is made available for oil and gas. A more widely held opinion, however, certainly including that of oil men themselves, is that consumer rationing is out, barring a general war which is an "if" in all calculations.

According to statements by Washington officials a tight situation in steel and other critical materials does prevail and continues to slow down planned expansions of the oil and gas industry at home and abroad. Overseas, in fact, operations are on a "starvation" diet, as PAD sees it, and the outlook for the remainder of this year is not encouraging.

Domestic producers have fared comparatively well, with steel being made available to drill 43,000 wells, at least. But oil and gas pipe lines are being allocated but half the steel they want for the third quarter. As a result, PAD was forced to take steps to forbid natural gas distributors from taking on new customers in areas of tight supply of gas. Steel supplies for refinery construction are well below demands, and the marketing segment of the industry is receiving but a small fraction of what it wants and had a year ago. Plate for storage is below demands. That is the Washington story.

A total of 2,336,470 tons of steel is sought for the oil and gas industry, at home and abroad, for the fourth quarter of this year by the Petroleum Administration for Defense. The Defense Production Administration has the final say on whether this amount will be forthcoming, assuming it is within the capacity of the steel mills to produce the quantities, which also is considered questionable. This is particularly true as regards certain items such as line pipe. The total is greater than DPA's third quarter allotment of 1,808,000 tons under the Controlled Materials Plan which went into effect at midyear.

Domestic operations would take 2,136,404 tons of the fourth quarter steel, compared with 1,580,000 allowed in the third quarter, a quantity which was less than 70 percent of PAD's request. Even of this amount, only 85 percent actually will be forthcoming, PAD says. Overseas operations would take 146,936 of the fourth quarter tonnage, and Canadian operations 53,130 according to PAD.

Fulfillment of the steel allotment, for use outside the United States, if approved by DPA, would permit attainment of PAD's target of a minimum of 2,435 wells this calendar year, some 645 in the fourth quarter. Of the year's total, 1,272 would be in the Caribbean and Middle East, compared with 848 in those areas last year.

The drilling would bring average daily foreign production, exclusive of Canada, to a rate of 4,632,000 barrels daily, and fourth quarter output to 4,992,000 barrels daily.

In Canada, the steel allotment is designed to develop some 300 million barrels of new reserves a year, which is sufficient to support a production of 60,000 barrels daily. The potential production of the prairie provinces, chief source of Canadian oil, went up from 150,000 barrels daily at the start of this year to more than 175,000 by midyear. Production of 200,000 barrels daily is foreseen by the end of the year.

The Canadian program of PAD gives high priority to several refinery projects designed to bring about an increase of 85,000 barrels daily of capacity at a cost of $80 million. Two product pipe lines, from refining centers at Montreal, Quebec, and Sarnia, Ontario, to the industrial market of Southern Ontario, are high on the list of essential projects.

Imports of steel to the United States are important. Oil country tubular goods have been coming in at the rate of 12,000 tons monthly, and line pipe at the rate of 25,000 tons monthly.

All plans for petroleum expansion, and the steel needed, at this time are based on "minimums." If war broke out, or some other catastrophe occurred, there would be need for more of everything, pipelines, refineries and production, coupled with a strict rationing program.

## New President of ASME

Reginald J. S. Pigott, director of the engineering division of Gulf Research & Development Co., Pittsburgh, has been nominated as 1952 president of The American Society of Mechanical Engineers. Election will be by letter ballot of the membership, which totals more than 33,000 engineers. The new officers are to begin their terms at the conclusion of the ASME annual meeting next December. Mr. Pigott will succeed J. Calvin Brown, of Los Angeles, Calif., engineer and patent attorney. Director of engineering research of Gulf Research & Development Co. since 1929, Mr. Pigott's professional record is a long and distinguished one which includes 11 years in the design, construction and operation of central steam power stations; seven years in designing and constructing power and industrial plants; five years in metal manufactures; and 18 years in petroleum engineering research.

## Sun to Build Canadian Plant

Sun Oil Co. will build a 10,000 to 15,000 barrel refinery at Sarnia, Ont., Canada. Cost is estimated at $10 million. Scheduled completion date is March 1953. Catalytic Construction Co. is the principal contractor. The refinery will consist of combination atmospheric and vacuum distillation units and an 8,000 to 10,000 barrel Houdriflow catalytic cracking unit.

Site for the new refinery is a 120-acre tract fronting on the St. Clair River purchased from the Dominion Alloy Steel Co. Sun Oil Co., Ltd., has marketed in Quebec and Ontario since 1923. In 1949 a Canadian production division was established at Calgary. Since that time the company has intensified oil exploratory efforts in Western Canada.

## Plan New Canadian Line

Socony Vacuum Oil Co., Inc., Gulf Oil Corp., Imperial Oil Ltd., and the Bechtel interests have become stockholders of Trans Mountain Oil Pipe Line Co. and have subscribed equally for an initial capital of $500,000. These funds will be utilized to cover the costs of completing engineering and field surveys on behalf of Trans Mountain for an all-Canadian pipe line route from Alberta to the Vancouver area. On completion of these studies the three oil companies, together with others who may participate, will determine whether to proceed with construction which would cost between $60 million and $100 million, depending upon the size and capacity of the line. Trans Mountain received its charter from the Canadian Parliament earlier this year.

# Head Office Staff Changes

# Announced by Standard-Vacuum

Philo W. Parker

H. W. McCobb

George F. James

Edward N. Leibacher

Harold Midtbo

IN a series of organizational changes in its New York offices P. W. Parker has been elected president of Standard-Vacuum Oil Co. He will continue to be the chief executive officer of the company as in the past when he held the title of chairman of the board. He had been chairman since 1946 and for 12 years prior to that was president.

L. V. Collings, general counsel, has resigned as vice president to become chairman of the board, thus filling the office vacated by Mr. Parker. At the same time H. W. McCobb, also a director, has been elected a vice president of the company.

A newly-formed executive committee, headed by Mr. Parker and with vice president H. F. Prioleau as its vice chairman, is empowered to function between meetings of the board of the oil company.

Edward N. Leibacher and George F. James have been elected directors, one to fill a vacancy created when L. W. Elliott, former president, recently resigned to become a director of Standard Oil Co. (N. J.). The other appointment represents an increase in Stanvac's board membership from nine to ten. Mr. Leibacher has been coordinator at New York for the company's interests in Indonesia. Mr. James has been treasurer, and will be succeeded by Harold Midtbo, formerly an assistant treasurer.

The Stanvac organization is one of the integrated units in the world oil industry. It carries on exploration, producing, refining, transport and marketing operations in countries stretching from the Cape of Good Hope to Japan, the Philippines and New Zealand. It provides employment for about 40,000 people.

Edward N. Leibacher, a newly-elected director of Standard-Vacuum Oil Co., has been associated with the international oil industry for nearly 35 years during which time he has filled technical and managerial posts in the United States, Europe, and in the oil-producing areas of Sumatra in Indonesia.

A graduate of Pennsylvania State College in 1916, Mr. Leibacher entered the oil industry in that year as an engineer at Esso's Bayway refinery at Linden, N. J. In 1928, he went to Sumatra to supervise refinery construction work at Sungei Gerong near Palembang. After returning to the U. S. he joined Standard-Vacuum's New York staff in 1933 and was named assistant general manager of that company's producing and refining affiliate in Sumatra in 1937, a position he held until the Japanese invasion of the island in early 1942.

Following World War II, Mr. Leibacher returned to Sumatra as general manager and headed an extensive post-war rehabilitation program of the company properties there. In 1947 he returned to New York as coordinator of Indonesian affairs for Standard-Vacuum, the position he held at the time of his election to the company's board of directors on June 12.

Along with this active petroleum career, Mr. Leibacher has seen active military service in both world wars. In World War I, he was promoted through the ranks to captain of Infantry, and in World War II served as a colonel on the Army-Navy Petroleum Board after joining American military forces in the Southwest Pacific.

George F. James, now a director of Standard-Vacuum Oil Co., has been that company's treasurer for the past two years. He has a broad background in the field of international finance. Prior to joining the company as an attorney in 1944, he was an associate professor of law and assistant dean at the University of Chicago, as well as a practicing attorney in Chicago. He is chairman of the section of the International Fiscal Association and of the U. S. tax committee of the National Foreign Trade Council.

Harold Midtbo, newly-elected treasurer, began his oil industry career in 1933 and has been an assistant treasurer of Standard-Vacuum since 1942. During that period he has traveled extensively to Europe, the Far East and South Africa on company missions involving financial and exchange control policies.

Mr. McCobb has been engaged in foreign oil producing activities for the past 24 years, except for his military service during World War II. He first went out to Indonesia to become production superintendent in South Sumatra in 1934. Three years later he was made production manager and remained there until the Japanese invasion in 1942. After his military service he returned to Indonesia in 1946 to help rehabilitate the producing properties. He was made head of Standard-Vacuum producing operations in 1946 and a director in 1947.

# Secondary Recovery As A Factor in the National Economy

By Dr. O. W. Willcox

THE necessity of bringing into exploitation the residue of oil in fields that have been abandoned or are nearing abandonment is growing more urgent with every passing year. Nearly everywhere in the United States, and especially east of the Mississippi, it is becoming more difficult and more costly to find virgin oil fields. Some ten years ago about 19 percent of the oil industry's income was being expended on search for new oil. At the present time the struggle to keep oil production in balance with consumption in this region is costing 35 percent or more of income, and in some states, as West Virginia, Pennsylvania and New York, very little new oil is being found. In Indiana, Illinois, Kentucky and Michigan the balance is barely maintained by a margin of about 10 percent.

The question has been asked: "Why should the populous eastern states worry about the inability of their local oil industries to produce enough oil to meet the demand of local consumption since the prolific fields of the southwest are keeping output in pace with the growth in consumption."

This question has been conclusively answered by Paul J. Torrey, chairman of the Secondary Recovery Committee of the Interstate Oil Compact Commission. Taking the state of Illinois as an example, Torrey points out that the known residue of oil in Illinois that can be recovered by secondary methods amounts to 350,000,000 barrels. He then proceeds to calculate what this reserve is directly worth to the people and the government of Illinois under existing prices and tax schedules. The tax returns to the state and its subdivisions amount roundly to a quarter billion dollars while the disbursements of the industry for wages, transportation and materials is more than twice that amount. This is an economic stake worth preserving both for the fiscal interest of the state and for its contribution to labor and industry.

It would seem obviously to the advantage of Illinois to encourage in every possible way the extensive application of methods for increasing the recovery from its oil fields. Some of the secondary reserve may and undoubtedly will be produced under existing conditions and laws. But the Illinois legislature does not seem to have its eyes open to the situation. Illinois, like too many other states, has no adequate law that would enable the unit operation of oil fields, which would go a long way to insure the general application of advanced methods of secondary recovery, with substantial and far-reaching benefits to land owners, to operators, to the state government, and its people. Absence of a law for proration of production has permitted in many areas a town-lot scramble for maximum production with much attendant damage and waste. But alongside of this free-for-all there have existed projects that demonstrate the feasibility of increasing the ultimate recovery of oil from all Illinois oil acreage by an average of at least 1,000 barrels per acre.

Conclusion is that all the states that are without laws that encourage unit operation of oil fields are subjecting their own economies to unnecessary disadvantage. Some objectors still point to the fact that secondary recovery operations by water-floods have been signally successful in the oil fields of New York and northwest Pennsylvania without adequate state laws. The answer is found in the fact that in this region the producing formations are generally of low permeability, which very effectively prevents a rapid movement of the fluids through the reservoirs even under high pressure differentials. This situation differs very much from conditions in various important regions in the west and southwest where a small number of wells could drain off the oil from surrounding properties on a field of moderate size. And throughout the Penn Grade area there are highly successful voluntary cooperative and unitized areas that prove the advantage of unitization even in a region where unitization seems to be the least necessary.

The importance of a state oil industry to the economics of the state with special reference to secondary reserves, is illustrated by other examples. California now has a large reserve, but it needs about 300,000,000 barrels of new production annually to meet the current needs of its own area; new production of this magnitude has not been forthcoming for a number of years, and consumption has grown to the point where current production is barely able to balance withdrawals. Obviously, the California operators must eventually apply effective secondary recovery methods, using gas and water injection procedures, if they wish to extract full value from their investments.

The narrowness of the margin between production and consumption in California is pointed up by recent imports of Borneo oil, and by the appearance of projects for pipe lines to bring crude oil from West Texas. In any event the California consumers will be supplied, but in proportion as their wants are satisfied from outside sources the economy of their state will deteriorate for the reasons cited above. Over against this dependence on external sources there is the fact that successful secondary operations in this state would greatly increase future recoveries from existing fields. L. P. Stockman has given figures to show that California oil fields have yielded 8.58 billion barrels of crude oil, and that there is at least an equal amount of residual oil left from primary operations awaiting the application of efficient means for bringing it to the surface.

At present secondary recovery in California has made a relatively small beginning. There are now seven active projects which show that by applying the best engineering principles used in other regions it should be possible to accomplish desirable results. Many of California's productive horizons are deep, but it now appears that a depth of 7,000-8,000 feet is not necessarily a hindrance. One of the main obstacles to secondary recovery in California is the same as mentioned in reference to Illinois and other states: the absence of laws encouraging unit operations.

The case of Lost Hills field of Kern County illustrates the point. This field was closely scrutinized a few years ago and was found to have all the necessary qualifications for a good secondary recovery project. The operators pooled their records and cooperated in making the most exhaustive survey ever conducted in California. But there were too many irregular property lines and too many conflicting property interests so a very deserving project fell through, and must remain inactive until there is more light in California's legislative halls.

States like Illinois and California have arrived or are arriving at the point where they must do something to prevent their local oil economy from falling into decay. There are other states, like Pennsylvania and West Virginia, where the local oil industries have long passed the point where they could supply the needs of their states. Here, as elsewhere in the Appalachian region, there are practically no fields in primary production. The original energy of the oil reservoirs has been dissipated: natural water drives do not exist, and all fields are virtually depleted of oil-driving gas. Practically all the wells now operating are "strippers" except where secondary operations are functioning, and only about 20 percent of the known oil-bearing areas have been subjected to any form of secondary recovery. Yet it is known that there are still large quantities of recoverable oil in this region. The recoverability of this oil has been amply demonstrated in the Brad-

ford field of Pennsylvania where the absence of state unitization laws has not proved too much of a hindrance. The situation is very different in southwest Pennsylvania, where unitization is badly needed, and equally so in other regions of that state that have lately developed new production from deeper formations.

The case of West Virginia is pathetic. Here the oil industry has lost much and is rapidly losing more of its weight as a factor in the economics of that state. Total production to 1949 was 438,138,000 barrels. More than this should still remain to be recovered. Primary production has nearly reached the vanishing point, many wells produce an average of one barrel a day, and strippers are being abandoned at an "alarming" rate. The ratio of newly found oil to production during the past 10 years was 0.63 to 1.00. Under these conditions West Virginia will not have even a little primary reserve in 25 or 30 years. The West Virginians are doing something about secondary recovery; an incomplete survey by the Interstate Oil Compact Commission shows 44 gas-injection drive projects involving some 16,739 acres, which is a small fraction of the oil-bearing area; there are a few water-injection drives.

The area suffers from a lack of natural gas for repressuring by gas, but this could be remedied by storing in transit some of the vast quantities of pipe line gas coming from the west on its way to eastern markets, using for storage some of the old depleted fields. The use of this transient gas would have to be paid for, but many repressuring projects in the United States are operating profitably on purchased gas.

The handicap on the West Virginia oil economy is the still too common absence of adequate legislation to facilitate unit operation of secondary recovery projects. Freed from such hobbles the state's oil operators could pool their resources, attract new capital, and in time give more employment, benefit the land owners, and enlarge the tax revenues of their commonwealth.

The Interstate Oil Commission has labored long and valiantly to induce state legislatures to put the weight of their authority behind the principle of unit operation of all oil fields, and particularly behind projects for secondary recovery. It is hard to understand the mental inertia that stalls the rational development of local resources, which could bring very obvious benefits to local economies, both private and governmental. As Torrey aptly puts it, "The right of a state to regulate the production of oil and gas is based on well defined and adjudicated principles of reservoir energy in a field, and a necessity in the prevention of waste in the public interest." The long and short of the matter is that ideas that should have been dropped long ago are still keeping venturesome and efficient explorers for and producers of oil out of fields that badly need exploitation in the public interest. The oil men of the United States would do well to redouble their support of the Interstate Oil Compact Commission to the end that this objective may soon be consummated.

During the past 50 years the oil industry has acquired enough hindsight to realize that oil history as it has been recorded in Pennsylvania and West Virginia and other regions might have been different had the early operators known then what is known today about the physical factors of underground oil reservoirs and the forces acting on their contents. It is now clearly known that oil reservoirs in their dynamic aspects fall into two general types; those that are under a natural water drive like the East Texas field, and those where the driving force, if any, is supplied by natural gas dissolved in the oil. There are, of course, fields where the two forces are both present. In the first type the properly managed water drive will deliver 80 percent or more of the oil to the surface. In the second type, which represents the great majority of all oil reservoirs, the situation is more complicated, and the end result of maximum recovery can be attained only by a mixture of natural and artificial forces.

There are many instances of the benefits of gas repressuring where the operators of new pools have had the forethought to use it from the start and have been permitted to do it under state law. A few examples reported by R. L. Evans and R. P. Roe, reservoir engineers of Stanolind Oil & Gas Co. may be cited:

Olney Field, Texas—daily production without injection, none; with injection, 80 barrels.

New Hope Field, Texas—without injection, 600 barrels; with injection 2,150 barrels.

Glenn Pool, Oklahoma—without injection, 714 barrels; with injection, 1,983 barrels.

Delaware Childers Area, Oklahoma—without injection, 750 barrels; with injection, 3,500 barrels.

North Burbank Field, Oklahoma—without injection, 1,500 barrels; with injection, 7,250 barrels.

West Pampa, Texas—without injection, 675 barrels; with injection, 1,250 barrels.

Cedar Lake Field, Texas—without injection, 48 barrels; with injection, 70 barrels.

West Tepetate Field, Louisiana—without injection, 760 barrels; with injection, 1,720 barrels.

Midway Pool, Arkansas—without injection, 3,000 barrels; with injection, 7,800 barrels.

The above figures are for daily production. The anticipated ultimate recoveries without injection and with injection for six representative average fields are given as follows in barrels:

Olney Field, without 360,000; with 608,000.

Midway Pool, without 28 million; with 51 million.

Haynesville Pool, Louisiana, without 23 million; with 55 million.

Delaware Childers Area, without 26 million; with 51 million.

Schuler Field, Arkansas, without 30 million; with 65 million.

West Tepetate Field, without 3.7 million; with 6.8 million.

Many fields do not show such wide margins of benefit; some make even better showings, and it is by no means uncommon to find gas injections that were begun early more than doubling recoveries before the stage for artificial water drive is reached. This postponement and minimization of the water drive is considered desirable where suitable water is hard to come by, and for other technical reasons.

Managed in this way, a new pool opened in a unitized area, or where all interests voluntarily cooperate, may be 70 to 90 percent instead of only 30 percent depleted when a dissolved-gas drive is allowed merely to dissipate itself. This rational practice, when generalized with all or most new fields, will do away with the question of secondary recovery or at least make it of relatively small consequence in relation to the general oil economy of the country.

However, the United States has the task of recovering vast quantities of residual oil which the earlier producers through faults not wholly their own, were forced to leave behind. But the interests of the United States, and more especially the interests of the states concerned require that this important reserve be recovered.

The engineers of secondary recovery projects now have at their disposal an accumulation of knowledge and experience which they can apply to their particular projects, no two of which will be exactly alike. Much of this knowledge has been accumulated in the Bradford field in Pennsylvania, where the producers have an organization in which information is pooled and which supports research on the problems of oil reservoirs. The research activities of such organizations are supplemented by research conducted at technical schools in states where the petroleum industry is of importance, and by the U. S. Bureau of Mines. In this backlog of scientific knowledge the secondary recovery engineers can find principles that have specific applications to a wide variety of cases. Intelligent use of these principles will almost guarantee success, or at least enable the engineer to avoid a dangerous risk.

Definition of the body of recoverable oil will require a minute examination of existing wells whether now producing or abandoned. Every stratum in the oil bearing zone must be cored to determine oil and connate water content, and especially to reveal the locations of zones of variable porosity and permeability which must be taken into account in the design of the project. This preliminary exploration will dictate the spacing of the producing and injection wells, and the pattern of spacing. External circumstances will dictate whether recovery shall be by repressuring with gas or repressuring with water. Since repressuring by water may in the end be necessary for the most complete recovery, arrangements may be made to follow gas with water. In the case of water-floods the availability of sufficient water must be considered, and also the disposal of water produced with the oil. The quality of the injected water must be carefully controlled to avoid costly corrosion of the well equipment.

The actual design and operation will depend on what the engineer has found from his prior study of the reservoir; the thoroughness of this study will forecast the success of the project or the wisdom of rejecting it. In the design very much depends on an understanding of the porosity and permeability relations and the distribution of permeability so that precautions may be taken to establish uniform flow of the repressuring medium (avoidance of by-passing). Research has demonstrated that the permeability of oil sands is often directional, that is, the line of easiest flow extends in a certain direction.

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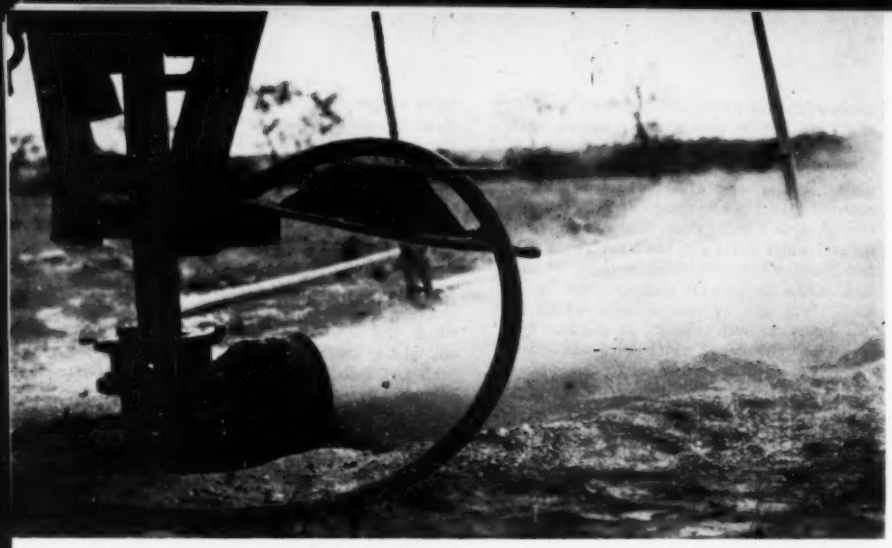


Limestone cuttings being directed through deflector which prevents the rise of dust and cuttings.

Pile of cuttings represents about 150 feet of hole drilled near Big Lake, Texas. →

# Air Drilling In Seismic Surveys

By W. E. Burke

DISCUSSION in the March issue of WORLD PETROLEUM of the use of compressed air in drilling, particularly in shot hole drilling in seismograph surveys, has brought out numerous evidences of the general interest in this subject and of the results obtained from actual field tests. The following is based upon the experience of Seismic Explorations Inc. in drilling operations in connection with its surveys.

Since September 1950 the company has been working and experimenting with air drilling in the arid parts of West Texas and New Mexico as a means of offsetting the cost and time involved in blind holes and the unusually long water hauls, sometimes from 10 to 15 miles over rough terrain and sand dunes. Such long hauls represent a cost of from five to ten dollars per load.

While the method has not as yet proved practical in all areas, it has been successful in medium and hard formations. Near Big Lake, Texas, on the Edward Plateau, an Ingersoll-Rand 315 cfm compressor line was tied into the discharge line of a standard medium weight shot hole rig using 2⅜" o.d. drill pipe and a standard 4½" tricone rock bit. A three way plug valve was installed in the discharge line of the rig so that by a 90-degree turn of the handle either air or water could be used. The compressor hose had a quick coupler on the end so that connections could be made easily and quickly at the plug valve. The first attempt in this area produced a 508-ft. hole in 17½ hours through limestone practically all the way. At about 350 feet a cavernous area was hit. If drilling had been done with water this would have produced a blind hole and circulation would have been lost, but the air blew the cuttings into the crevices and after a while continued to the top. Water was encountered at the 400-foot and 500-foot levels but the air pressure of from 20 pounds to 60 pounds, 100 pounds per square inch being the maximum, was sufficient to clean the hole of both water and cuttings. The drill pipe was removed without difficulty, which was not so with water drilling in that area, and the hole was easily loaded to the bottom without having to resort to a heavy jarring tool to push it through.

In much of the area where water was used as the drilling medium and drilling mud was used to pack off blind spots, some of the holes would cave in and prevent the charge from being lowered to the bottom even with the aid of heavy jarring tools. In this same section a water rig was also being used just a short distance from the air drill. Two of its holes had to be abandoned due to blind holes and lost circulation which caused lost time and added expense for the many water hauls which were made in the attempt to complete the holes. A short time later when it was evident that the air drilling was progressing faster at less expense the water drill was stored and the prospect was completed with air alone, including the reworking and completing of the abandoned holes.

W. E. Burke

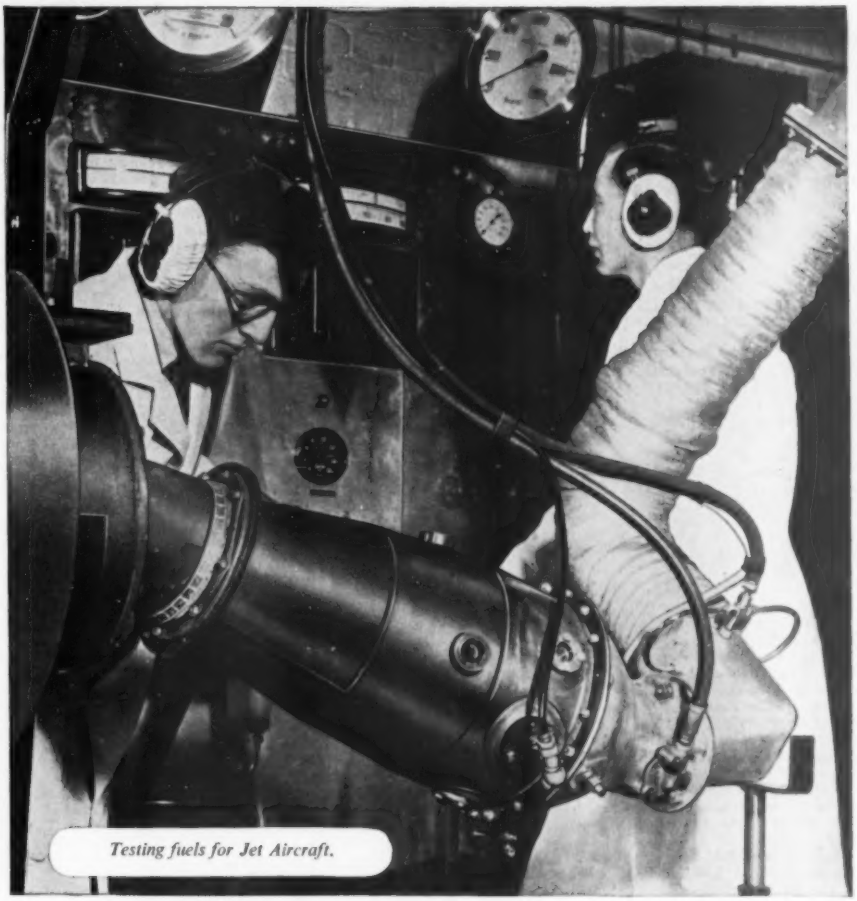
An interesting experiment was conducted on one shot hole that was drilled and completed with water. The hole was some 440-feet deep and in attempting to come out the bit was stuck tight by falling cuttings. After hours of working on it with no success it was decided to try air to clean the hole, although it appeared doubtful due to the fact that the 100-pound maximum air pressure available was not sufficient for a 440-foot head of water and mud. Air was tried for 15 minutes with no effect, then water under higher pressure was circulated but the pipe would not budge. Air was used again for a few minutes and then water to get an upward movement and to compress the trapped air below. Then by quickly switching to air again two separate columns of water blew out the hole to a height of approximately 20 feet above the top of the mast. This accomplished the job, for the hole was thoroughly cleaned out and the drill pipe was recovered.

In areas where sand and gravel predominated, water drilling often proved more efficient; that is, where water was readily accessible, for the use of heavy drilling muds and other mediums were available to seal off the loose sand and gravel. The use of air in this type of drilling had its handicap in that there was no efficient way to keep the loose formation from falling back into the hole. However, the company experimented with air drilling near

*(Please turn to page 67)*

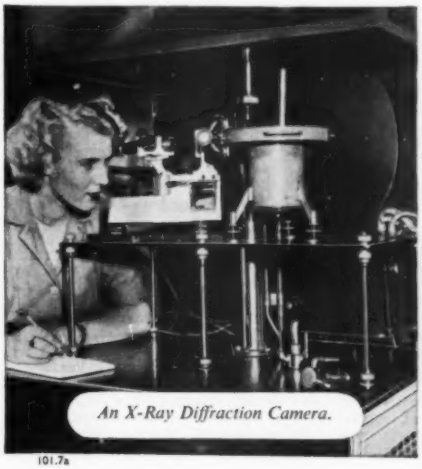
# Test Pilots

OIL producers and refiners in the Middle East since 1912, Anglo-Iranian Oil Company and its associated companies also operate eleven refineries in the United Kingdom, France, Germany, Italy, Israel, Irak, Kuwait and Australia; their sales organisation includes major marketing or supply interests in Europe, Asia, Africa and Australasia, with international ships' bunkering and aviation services.



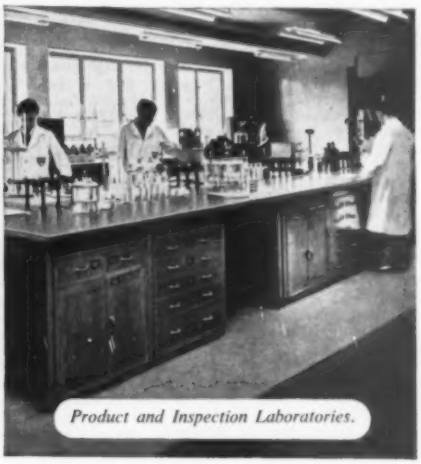
*Testing fuels for Jet Aircraft.*

World-wide petroleum research activities centre on Anglo-Iranian's principal research establishments at Sunbury, Middlesex, and Kirklington Hall, Nottinghamshire. Since 1915 Anglo-Iranian has continuously developed and pioneered the application of scientific research to the problems of discovery, refining, and utilisation of crude oil and its products.



*An X-Ray Diffraction Camera.*

101.7a



*Product and Inspection Laboratories.*

BP

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**REPRESENTATIVE IN U.S.A.**
**W. D. HEATH EVES**

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# International news and notes

## Venezuelan Production

Venezuelan production averaged just under 1,700,000 barrels per day in May and just over that figure in June, according to statistics not yet complete. The following comparison with early 1950 clearly shows the present trend to higher levels:

| | B/D, 1950 | B/D, 1951 | Increase |
|---|---|---|---|
| January | 1,464,687 | 1,634,400 | 10.3% |
| February | 1,319,551 | 1,635,901 | 13.2 |
| March | 1,387,434 | 1,678,220 | 17.3 |
| April | 1,441,105 | 1,689,368 | 14.7 |

Final figures for April are broken down by companies in the table below:

| Company | Eastern Venezuela | Western Venezuela | Total |
|---|---|---|---|
| Creole | 140,299 | 574,768 | 715,067 |
| Shell Co's | | 518,336 | 518,336 |
| Mene Grande | 237,554 | 63,483 | 301,037 |
| Texas-Mercedes | 32,606 | 13,945 | 46,551 |
| Socony-Vacuum | 46,633 | | 46,633 |
| Ven. Atlantic | 20,364 | | 20,364 |
| Richmond | | 12,757 | 12,757 |
| Sinclair | 11,709 | | 11,709 |
| Pantepec | 10,019 | | 10,019 |
| Phillips | 5,964 | | 5,964 |
| BCO, Ltd. | | 931 | 931 |
| | 505,148 | 1,184,220 | 1,689,368 |

In Western Venezuela, Creole's Las Polonias-1, several miles southwest of the Cumarebo light-oil field, was drilling below 4,000 feet in early July. The Texas-Creole joint test Roma-1 was under 8,000 feet in its search for a new pool in the prolific Cretaceous limestone Mara field. Texas Company's El Cocal-1, on the shore of the Gulf of Venezuela near the western base of the Paraguana Peninsula, was abandoned at 9,649 feet about the end of June. Another location on the Gulf was announced by Texas-El Callao-1, about 25 miles west of El Cocal-1. This new field wildcat was scheduled to spud in early July.

Another new field test was Shell's Pauji PJ-1, fishing at about 3,500 feet, 15 miles southwest of the Mene Grande field. The same company's CQ-1 was diamond-coring near 11,000 feet in the vicinity of the mountain town of Valera, while their Canadones DMC-2, northeast of the Mara field was coring below 6,000 feet. LS-1,387, Shell deep test five miles out in the lake from the Pueblo Viejo field, was drilling below 4,000 feet. Shell's Quiroz QZ-1, 22 miles south of BCO's El Mene field, was preparing to complete at a final depth of 3,467 feet, as a new field discovery. Their outposts in the recent Sibucara field, Sibucara-7 and 8, were drilling below 10,000 and 7,500 feet respectively. C-150, Cretaceous deep test in the Concepcion field, was drilling near 9,000 feet, while C-149, Cretaceous test in the San Ignacio area, was fishing at about 8,000 feet. Shell's development of the West Tarra field, in southwest Venezuela near the Colombia border, continued with the drilling of outposts WT-11 and 12.

On the Colombian side of the Gonjira Peninsula, where Colombia and Venezuela have a common border, Richmond spudded Perico-1, at a location 25 miles southwest of the town of Rio Hacha.

In Guarico (Central Venezuela), Atlantic abandoned new field wildcat Anibal-2, in which Socony was a partner, at 5,357 feet. Another Atlantic-Socony joint test, Retumbo-1, had been scheduled for this portion of southeast Guarico, but heavy rains forced postponement for at least a month. Meantime, Atlantic continued exploratory drilling in the Tucupido and Saban areas with a series of slim holes, the most recent of which, SaGX-4, was a minor new pool discovery. Copa-2, second hole in Atlantic's recently-discovered Cocomon field, was preparing to test as July began, and Ruiz 3-71 was completed with casing at 1,680 feet for the shallowest pool yet found in Ruiz. Texas Company's Valle 17-1 and 17-2, offsetting the Ruiz field to the north, have now both been abandoned as dry. Sinclair were preparing to run casing at 7,410 in Piedra-Azul-1, wildcat eight miles north of the Tucupido field. Texas' Palacio-63, shallower-pool test in the Mercedes field, was abandoned at 3,580 without running casing. Mercedes-221 and 228 continued the search for new pools in this area.

In Eastern Venezuela, Pantepec's El Roble RPN-27 was brought under control on June 5 after blowing wild since the end of April. Paul Adair, of the Kinley firm, had been in charge since the first few days of the blowout. Though the danger was constantly present, no fire occurred, and a few days after being capped the well was behaving normally as a producer of 500 barrels per day of 55.7° condensate on one-half inch choke.

Phillips completed Aragua-6 in June and was preparing to spud Arugua-8 as July began, while drilling ahead on Laloma-3 at about 8,000 feet. Sinclair completed Guere-4 for 675 barrels per day on a one-quarter choke, and Guere-5 was at about 3,000 feet in early July. Socony abandoned Chimire CHV-63R at 7,943 feet, but completed Guario 30-A in the Anaco area as a new pool discovery from two zones gauging a combined 1,100 barrels per day.

Mene Grande completed new pool test CaM-301 in the Caico Seco field as a dual-zoner with a combined daily gauge of 580 barrels, and continued drilling on rank wildcats Apamate-1 in western Anzoategui, and Divi-1, in northern Anzoategui, at 7,500 and 5,000 feet respectively. The same company also spudded GXG-401 as a new pool test east of the West Guara field, FXM-101 as a new pool test in Central Fria, and were rigging up on an East Caico Seco wildcat as Juy began. Texas Co. was approaching 12,000 feet and final depth on Mata-2, north of Mene Grande's Chive field.

Farther east, Creole abandoned Cuanoco-1, near the famous asphalt lake, at 6,198, and prepared to spud Guanoco-2 at a point 10 miles to the southeast, in the vicinity of Cana La Brea. Q-533, a deeper-pool test in the Quiriquire field (the oldest producing field in Eastern Venezuela), was temporarily suspended while crews worked at East Maron-2. This latter wildcat, a couple of miles from the peculiar Capacho field of Monagas (the first hole was a producer, while eight succeeding stepouts were dry holes), is scheduled to go to about 11,000 feet. Creole is the operator, and Mene Grande is joint owner of the concession.

## Orifice Plates

George Kent Ltd., Luton, England has a new orifice plate for use with viscous liquids such as lubricating oils. The usual orifice plates, while being quite suitable for water and non-viscous liquids, are subject to serious errors when used for viscous liquids, whereas the new orifice will give correct rates of flow over wide ranges of viscosity.

## Mexican Wildcat

An exploratory well on the Tecominoacan structure in the Tehuantepec Isthmus area of Mexico has been begun by Mexican American Independent Co., known in Mexico is CIMA, which recently reported an important oil discovery at Rabon Grande, on the coast near the city of Coatzacoalcos, Mexico. Tecominoacan is located some 55 miles to the east and inland from Rabon Grande. Seismic survey work has indicated the existence of a structure of large areal extent. The location selected for CIMA's first test well is in a region where heavy jungle growth and frequent tropical storms impose unusual transportation and operating problems.

## Signs Colombia Operating Contract

International Petroleum (Colombia) Ltd., has concluded an agreement with the Colombian National Petroleum Co., Empresa Colombiana de Petroleos, under which it will operate the Barrancabermeja refinery after August 25 when the plant reverts to the government. The refinery was built by International to process crude from the De Mares concession which it has operated for more than 30 years. Negotiations between International and government authorities have been in progress for many months.

International Petroleum Co., Ltd., of which International Colombia is a subsidiary, has agreed to lend Empresa $10 million to help defray the cost of a major refinery expansion plan. Crude capacity will be increased by 35,000 barrels daily. A fluid cat cracker, feed preparation unit, aviation alkylation unit and other facilities estimated to cost $20 million will be erected.

International Colombia will pay the Empresa a fixed annual rental plus a fee which will vary with the volume of refinery throughput. Empresa will repay the refinery loan in ten years. The agreement is for 10 years from date of refinery completion although either party may cancel after seven years.

International Colombia has undertaken to purchase crude from the Empresa, and under Colombian price-control regulations will sell the refined products required for consumption in Colombia at prices equal to the average of Platt's U. S. Gulf. Products, including reduced crude, not sold in Colombia may be exported.

International Colombia has agreed also to provide Empresa with technical assistance on the production of crude oil from the presently producing areas of the De Mares concession. Such assistance will be provided at cost for a period of from three to five years as Empresa elects.

## Davey, Paxman & Co. Ltd. Appointments

Davey, Paxman & Co. Ltd., of Colchester, has announced new appointments as follows: W. A. Sycamore assumes the title of defense program manager to coordinate the firm's activities with the Admiralty and other government departments in connection with the national rearmament program. H. V. Stead, M.Sc., is appointed commercial manager (engines) and H. P. Brown becomes his assistant. J. A. Bennett-Powell is appointed traction sales manager.

## Chemistry in Astronomy

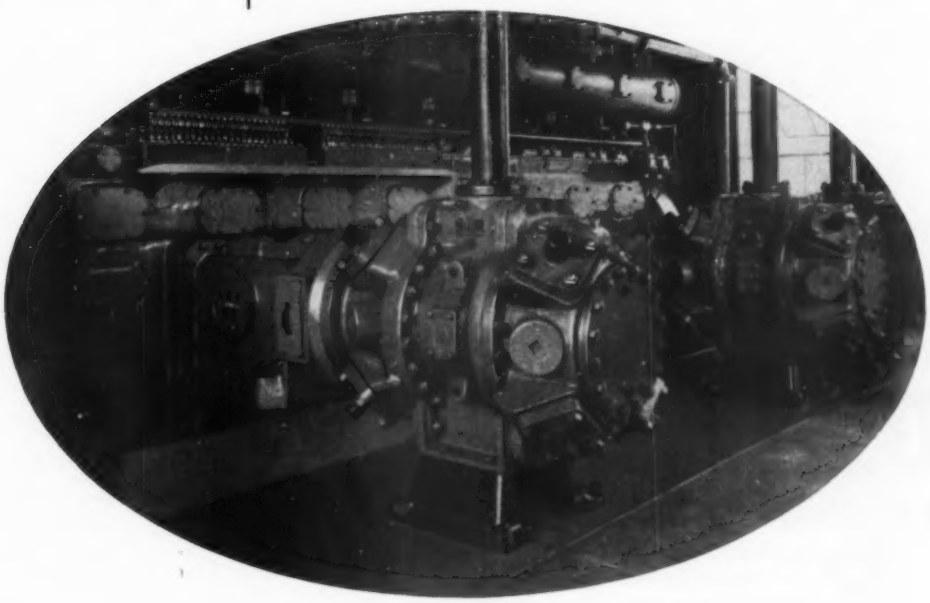
The American Cyanamid Co. has arranged a special program at the Hayden Planetarium of the American Museum of Natural History in New York during the 75th Diamond Jubilee meeting of the American Chemical Society. Members and guests have been invited by American Cyanamid to a special presentation relating chemistry to astronomy. The lectures have been made a part of the regular program of the ACS and the International Congress meetings. Complimentary tickets may be obtained by writing to the Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J.

## Badger Process Division Formed

It was announced recently that the activities formerly engaged in by E. B. Badger & Sons Co. and Stone & Webster Engineering Corporation's process division will be carried on hereafter by the Badger Process Division of Stone & Webster Engineering Corp. These activities consist of engineering and construction services for clients in the chemical, petro-chemical, petroleum and pharmaceutical industries. Erastus B. Badger, who has been president of E. B. Badger & Sons Co., has been elected a director of Stone & Webster Engineering Corp., and Ralph D. Waterman, formerly vice president of Badger has become a vice president of Stone & Webster.

Insure dependable performance
of pipe-line compressor units,
reduce maintenance costs

with **Gulf Security Oil**



You make a two-way savings when your pipe-line compressor units are lubricated with Gulf Security Oil—lower maintenance costs, less out-of-service time.

Gulf Security Oil provides outstanding protection for bearings and cylinder walls in both engines and compressors. After years of operation with this quality lubricant, equipment shows remarkable freedom from cylinder wear and a minimum of carbon deposits on valves and rings.

Because of its excellent resistance to oxidation, Gulf Security Oil stands up for many hundreds of hours without appreciable change in its original properties. And because oil control rings are kept clean, oil consumption is remarkably low.

Many operators of units lubricated with Gulf Security Oil report that this quality oil insures more operating hours between overhauls and helps them avoid unscheduled shutdowns. And Gulf's delivery service is tailored to meet the needs of every pipe-line operator.

For complete information on Gulf Security Oil and for expert help on any lubrication problem, call in a Gulf Lubrication Engineer today. Write, wire, or phone your nearest Gulf office. Gulf Oil Corporation · Gulf Refining Company, Gulf Building, Pittsburgh 30, Pa.

FIFTY YEARS OF SERVICE
1901 GULF 1951
PETROLEUM AND ITS PRODUCTS

O. S. Petty | P. J. Rudolph | V. A. Petty, Jr. | W. L. Crawford | W. L. Moore

## Petty Geophysical Elects New Officers

O. Scott Petty has been elected chairman of Petty Geophysical Engineering Co., San Antonio, Texas. Mr. Petty has been president of the company since it was founded in 1925. The Petty firm is now the oldest geophysical firm in the United States with continuous service to the oil industry.

Mr. Petty is succeeded as president by P. J. Rudolph who has been with the firm since 1932. He formerly was in charge of the company's Tulsa offices but was transferred to headquarters in 1942 and made general manager two years later.

Weldon L. Crawford, who was elected executive vice president and treasurer, has been assistant general manager since 1944. He has had many years' experience both in the United States and in foreign fields. His first geophysical work was for Shell in 1930 followed by work on a Petty refraction crew for International Petroleum Engineering Corp. in South America in 1931 and 1932.

Van A. Petty, Jr., who was re-elected vice president and secretary, is a native San Antonian. He first joined Petty Geophysical in 1934 leaving later to get his college education after which he did scouting work for Union Producing Co. and Navarro Oil Co. He rejoined the Petty company in 1942 and upon the death of his father was elected vice president, which position his father had held before him.

W. Lee Moore, who was elected vice president, has for the past six years been in charge of Petty's Tulsa office. He first joined Petty in 1930 as a laboratory technician. He has had wide experience in instrument design and manufacture as well as in all branches of field operations and has supervised geophysical exploration all over the U. S. and in foreign fields.

Dabney T. Petty, one of the three brothers who founded the company in 1925, retired as vice president but remains a director. Members of the board include the five officers and Arthur L. Lay. Mrs. Edwina H. Petty retired as secretary.

The Petty companies are planning an expansion program. A 530-acre building site located a few miles north of San Antonio has been purchased and is considered to be the largest site so far dedicated solely to geophysical research. One of the highest hills in the San Antonio area is located on Petty's tract which will be of great advantage in future electronic surveying research. The company is now one of the largest geophysical firms in the world, employing 500 men in its international operations.

## Shell of Canada Promotions

O. B. Roger has been elected a director and A. L. Wilson appointed a vice president of Shell Oil Co. of Canada, Ltd. Mr. Roger will continue as vice president and treasurer in directing the firm's financial affairs. Mr. Wilson, as vice president, is in charge of Shell's Canadian marketing activities from coast to coast.

Mr. Roger has been associated with the oil industry for many years, having started his career with Shell Petroleum Co., London, England. He came to Canada in 1929 and has directed the financial affairs of the Canadian company since that time. He was appointed vice president and treasurer in 1946.

Mr. Wilson joined Shell as a service station attendant in 1932. During World War II he was loaned to the British government for wartime duties with the British Merchant Shipping Mission in Washington. He was appointed marketing manager in 1949 and continues in charge of this phase of Shell's activities.

## Pacific Valves, Inc., Expands

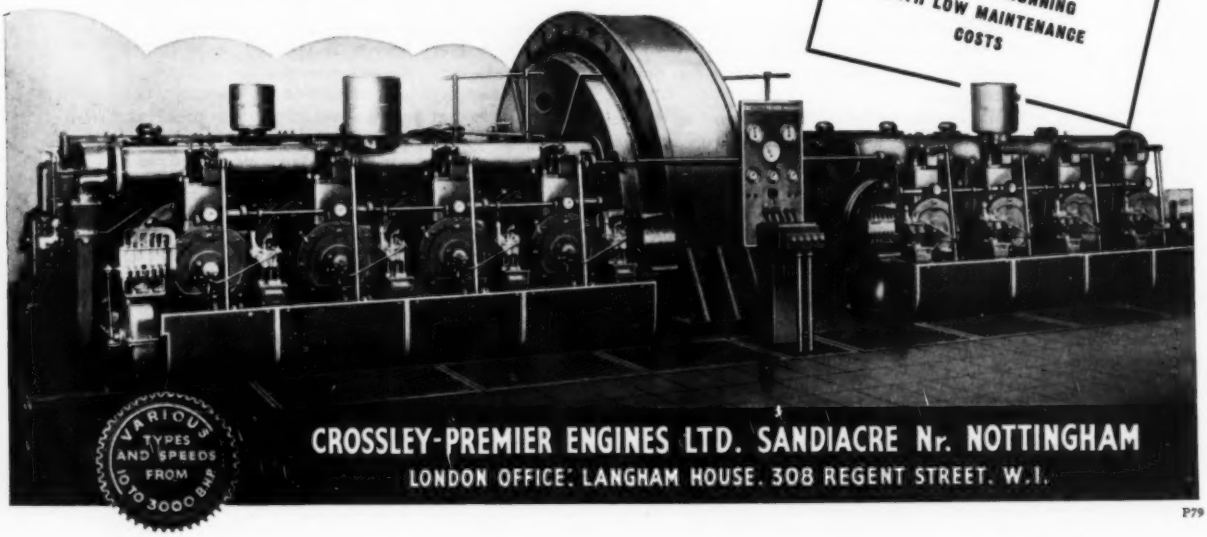
Pacific Valves, Inc., 3201 Walnut Ave., Long Beach, Calif., has recently completed another phase of its long range expansion program, including the expansion of both its factory and offices. It is estimated this work will run well over $100,000 for building facilities, and an additional $350,000 for new machine tools. Pacific specializes in the manufacture of cast steel gate, globe, angle and swing check valves for refineries, pipe lines and chemical plants, in sizes from ¼ inch to 24 inches and in pressure ranges up to 1,500 pounds.


CROSSLEY-PREMIER

DIESEL ENGINE GENERATING SETS

9 engines totalling 13,200 B.h.p. operate the Bremang Gold Dredging Plant. One of the two latest is illustrated below

SLOW SPEED, MULTI-CYLINDER HORIZONTAL VIZ-A-VIZ ENGINES ASSURE RELIABILITY FOR LONG CONTINUOUS PERIODS OF RUNNING WITH LOW MAINTENANCE COSTS



VARIOUS TYPES AND SPEEDS FROM 10 TO 3000 B.H.P.

CROSSLEY-PREMIER ENGINES LTD. SANDIACRE Nr. NOTTINGHAM

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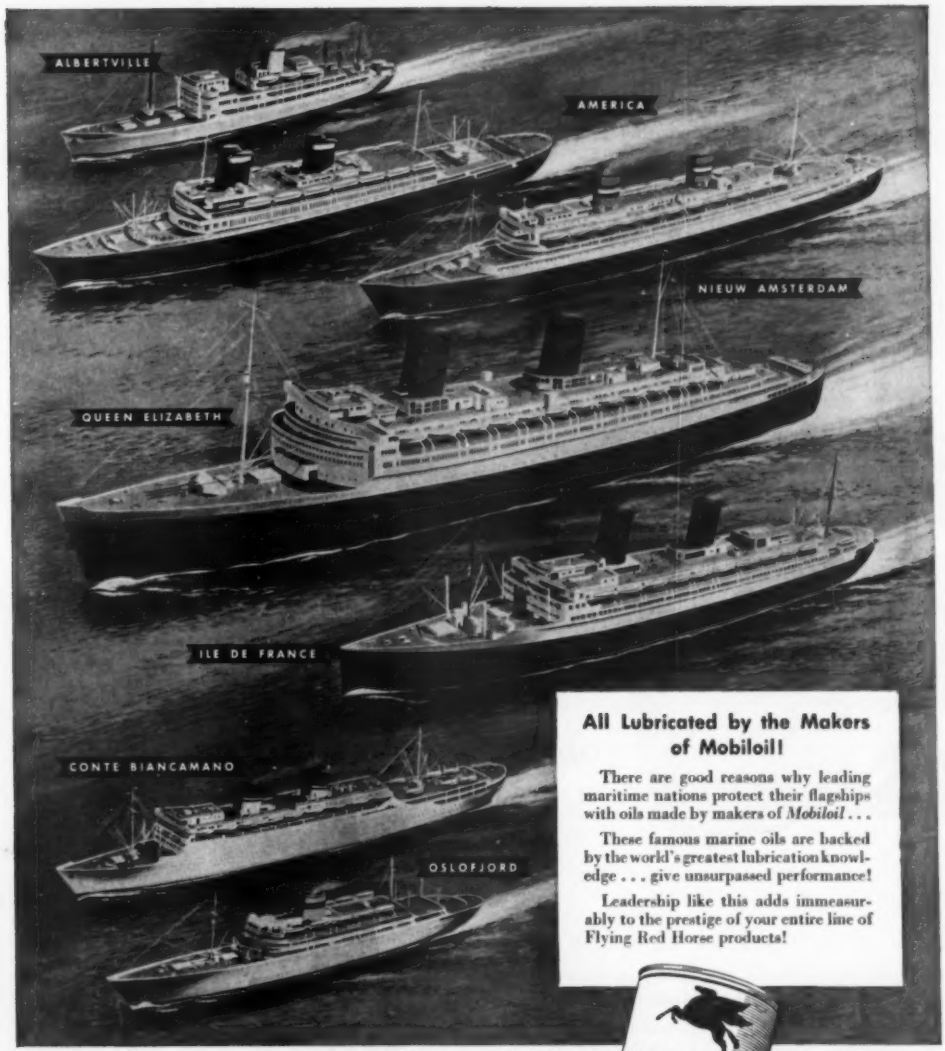
P79

# First With the Flagships




**All Lubricated by the Makers of Mobiloil!**

There are good reasons why leading maritime nations protect their flagships with oils made by makers of *Mobiloil*...

These famous marine oils are backed by the world's greatest lubrication knowledge... give unsurpassed performance!

Leadership like this adds immeasurably to the prestige of your entire line of Flying Red Horse products!

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# Mobiloil

Mobilgas

SOCONY-VACUUM OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

## To Fill Iranian Gap in Supply

A foreign petroleum supply committee, composed of executives of 19 American oil companies with overseas interests, is at work on plans for easing any shortages of crude and products that may arise through a cutting off of Persian shipments.

The formation of the voluntary agreement, under which the committee operates, took more than two months. It began in April when the danger appeared grave that Iranian oil supply might be curtailed; the committee came into being after the Justice Department gave its blessing from the antitrust standpoint, and Defense Mobilizer Charles E. Wilson invited the executives to become members. In July, Interior Secretary Oscar Chapman, who is Petroleum Administrator for Defense, formally named the executives as members of the committee.

Under terms of the agreement, and of interpretations put forth by government agencies, the committee is empowered to engage in such activities as the following:

"The joint utilization of storage and distribution facilities; joint use of tanker and other transportation facilities; the alteration of refined products through adjustments in quality specifications; exchanges, loans, sales and purchases of petroleum products; the joint utilization of tanker and cargo vessel capacity in such a manner as to eliminate or reduce to a minimum multiple port loading and discharging, cross hauling and unnecessary ballast voyages."

In actual operations, the committee will work very closely with Secretary Chapman, and his deputy, Bruce K. Brown, of the PAD. The Justice Department is to be kept informed of certain operations of the committee. Offices are located in New York, where the committee maintains a technical staff. The degree of activity of the committee will depend to a great extent upon the developments in the Iranian situation, although other world supply and demand factors will be given consideration.

The members of the committee, as named by Secretary Chapman in addition to Stewart P. Coleman, a director of Standard Oil Co. (N. J.) who has been appointed as chairman, are as follows:

| Company | Representative | Alternate |
|---|---|---|
| American Independent Oil Co. | Ralph K. Davies | Harley Stevens |
| Arabian American Oil Co. | W. F. Moore | J. T. Duce |
| Atlantic Refining Co. | L. A. Webb | J. D. Kurtz |
| Barber Oil Corp. | T. Rieber | H. Rieber |
| Caltex Oil Products Co. | W. H. Pinckard | E. A. Beverly |
| Creole Petroleum Corp. | R. W. Miller | L. G. Smith |
| Conorado Petroleum Corp. | A. A. Curtice | Christian H. Dohm |
| Gulf Oil Corp. | Col. J. F. Drake | Sidney A. Swensrud |
| Pacific Western Oil Corp. | D. T. Staples | C. F. Krug |
| Socony-Vacuum Co. | W. L. Faust | C. T. Crawford |
| Standard Oil Co. of Calif. | B. W. Letcher | T. L. Lenzen |
| Standard Oil Co. (N.J.) | E. E. Soubry | Stewart P. Coleman |
| Standard-Vacuum Oil Co. | P. W. Parker | L. V. Collings |
| Superior Oil Co. | W. M. Keck, Jr. | Roger E. Johnson |
| The Texas Co. | A. C. Long | A. W. Lilley |
| Tide-Water Associated Oil Co. | B. I. Graves | L. W. Parsons |
| Union Oil Co. of Calif. | Reese H. Taylor | A. C. Stewart |
| Venezuela Petroleum Co. | E. L. Steiniger | H. M. Russell |
| Sinclair Oil Corp. | P. C. Spencer | A. E. Watts |

The first such committee to be named was one on supply, but others on production, tanker transportation, refining, materials and overseas liaison are part of the set up.

The members of the supply committee already announced are:

Robert S. Hatch, Arabian American Oil Co.
J. D. Kurtz, Atlantic Refining Co.
E. A. Beverly, Caltex Oil Products Co.
F. M. Platts, Creole Petroleum Corp.
E. F. Perkins, Gulf Oil Corp.
C. T. Crawford, Socony Vacuum Oil Co.
H. H. Flynn, Standard Oil Co. of Calif.
J. A. Cogan, Standard Oil Co. (N.J.)
Elmer D. Smith, Standard-Vacuum Oil Co.
H. C. Holmes, The Texas Co.
Oliver Ambrose, Tide-Water Associated Oil Co.
H. M. Russell, Venezuela Petroleum Co.

## Agate Enters Mid-Continent

L. H. (Harley) Bowen, formerly in charge of sub-surface sales for Republic Supply Co., has been appointed Mid-Continent area representative for Agate Corp., according to R. B. Pridgeon, general manager. Mr. Bowen will be responsible for development of Agate filter sales and service in the Mid-Continent and will make his headquarters in Houston. Originally developed for use in California sand areas, Agate filters have been in use there since 1948.

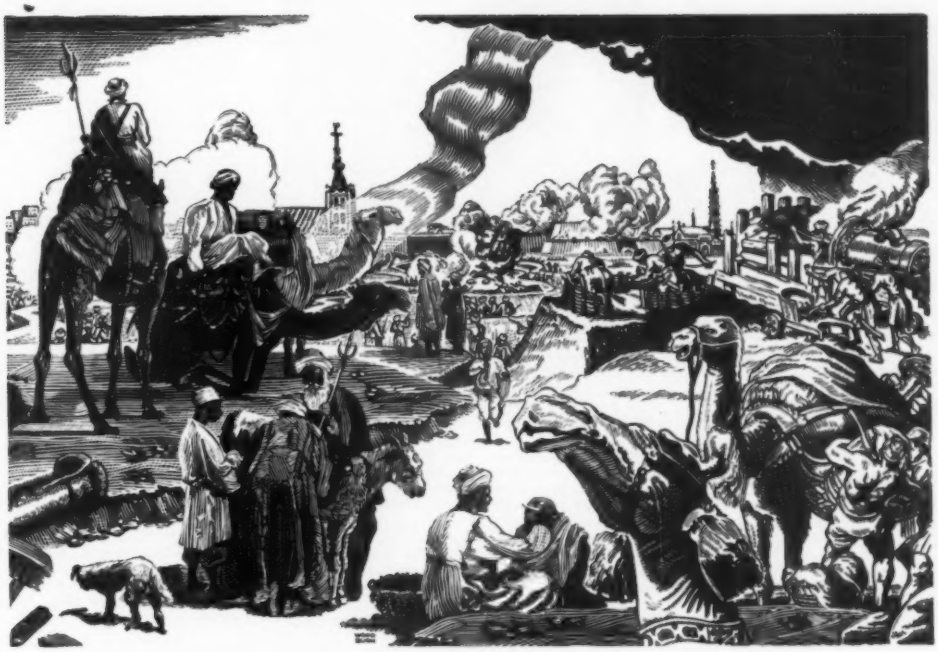
## New Diesel Engine

Nordberg Manufacturing Co. has developed a new method of obtaining additional cooling of intake air to its diesel engines to achieve a better thermal efficiency. Volume of intercooled intake air is increased and cooling within the cylinder itself is accomplished by blowing part of the air out the exhaust and secondly, closing the intake valve before the end of the intake stroke so that air is expanded from 15 to 6 psi and thereby cooled an additional 50 degrees. Mechanical efficiency of the new engine is stated to be 85.4 percent compared with 83.2 percent for a low pressure supercharged, non-intercooled model.

Out of touch with that change of plans you had to make 5 minutes after they drive away from the depot. A few words now could save time that is worth good money. As it is they might as well be lost in the Sahara—unless you install G.E.C. V.H.F. Radio Telephone Equipment; then you can be in immediate communication at any time with your transport speeding along and with your oil fields. You can have literally your own private 2-way Broadcasting Station—as simple to work as a telephone: the vehicle installations can also be used as a public address system. Compact and completely reliable, this set gives you a new power to handle a crisis, to seize an opportunity and drastically cut down running costs. *Please write today for full particulars.*

G.E.C. V.H.F. RADIO TELEPHONE EQUIPMENT

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON. WC2



# Steel saved civilization at Vienna

MODERN history begins with the record of conflict between Christians and Moslems--six centuries of wars that opened with the Crusades and saw the Turks capture Constantinople in 1453.

More than 100,000 Turkish janizaries and cavalry besieged Vienna in 1683. For two months, to quote the diary of an eye witness, "The enemy continued playing their cannon and granadoes. But the city walls were strong, Christian cannon were bigger and more numerous and ammunition more plentiful." Finally came a day when the officer's journal reported, "The enemy did not play their cannon so fast. It was confirmed that they had no great provision of bullets, inasmuch as they shot back not only our bullets, but also pummels of swords and all sorts of iron and stones."

At last a great Christian relief army was assembled. "They made an attack in the best order that ever army did. The enemy, forced always to give back, were put all into confusion. They betook themselves to flight, leaving all their provisions, ammunition, cannons and tents --the greatest part rendered unfit for farther use by our great guns."

Never again did the Turks seriously menace Christendom. Western civilization had been saved once more by its supremacy in the use of iron and steel. To aid our survival America's free private industry is producing steel at the highest rate ever known--and still expanding. The question remains--Will America use enough of this tremendous steel production to guarantee the continued supremacy of Western, Christian civilization?---We believe the answer is yes!

YOUR SCRAP IS NEEDED — YOUNGSTOWN

## The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
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MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

## Streamlines Ideco Management

Formation of Dresser Equipment Co., is announced by H. N. Mallon, president of Dresser Industries, Inc., Dallas, Texas. The new company is composed of two former Dresser Industries' subsidiaries, Kobe, Inc., and International Derrick & Equipment Co. The two will function as divisions of Dresser Equipment Co., itself an operating subsidiary of Dresser Industries, Inc.

Kobe will be a complete operating unit. Ideco will operate its three manufacturing plants located at Columbus, Ohio, Beaumont, Texas, and Torrance, Calif., as separate units under their own general managers. These Ideco managers will report directly to John B. O'Connor, who has been elected president of Dresser Equipment Co. in addition to being executive vice president of Dresser Industries, Inc.

## IHC Engine Catalog

Five International carburetor-type power units are graphically described in a 12-page two-color catalog recently released by the International Harvester Export Co. Ranging in size from 16.5 to 55 hp, these four-cylinder, four-cycle engines may be equipped to burn either gasoline, natural gas, distillate or kerosine. Engine and cutaway shots illustrate the booklet, E-63-A, copies of which are available upon request from Merchandising Services, International Harvester Export Co., 180 North Michigan Ave., Chicago 1, U. S. A.

## Moves Oklahoma City Offices

The mid-continent division of the Lane-Wells Co. has moved its offices from the Apco Tower to the newly constructed Oklahoma City location at 5800 North Eastern and is at the same location as the Lane-Wells shop. The modern building is of functional contemporary design featuring comfortable customer facilities including a large parking area.

Donald W. Champlin  Russell J. Wolf

## Kellogg Company Names Two New Officers

The naming of two new vice presidents, one to head up sales and the other to take charge of the company's manufacturing facilities in Jersey City, was announced by Warren L. Smith, president of The M. W. Kellogg Co. Russell J. Wolf, formerly assistant to the president, has been named vice president in charge of sales. He will also continue to supervise Canadian projects as a vice president of Canadian Kellogg Co., Ltd. Formerly general manager of the equipment manufacturing division of Continental Can Co., Donald W. Champlin is the new vice president in charge of Kellogg's manufacturing. His responsibilities include Kellogg's considerable annual volume in fabricated metal equipment for refinery, chemical and electric utility firms.

## LPG Specifications and Test Methods

A new publication containing all the generally accepted specifications and test methods for LP-Gases has just been released by the Natural Gasoline Association of America, Tulsa. Adopted as recommended procedures at the June meeting of the NGAA Board, the revisions of previous NGAA methods are the result of more than two years of study and research by the Technical Committee under the leadership of chairman H. A. Montgomery, Warren Petroleum Corp., Houston.

Others who played leading roles in the work were: J. R. Bailey, Continental Oil Co., Houston; F. A. Burdick, Shell Oil Co., Houston; C. D. Gard, Union Oil Co. of Calif., Los Angeles; C. P. Keeley, Pyrofax Gas Div. of Union Carbide & Carbon Corp., Speedway, Ind.; E. Y. Palmer, The Atlantic Refining Co., Merryville, La.; P. W. Tucker, Phillips Petroleum Co., Bartlesville; J. L. Thompson, Lone Star Producing Co., Dallas; and Joe F. Woof, Skelly Oil Co., Pawhuska, Okla.

Known as NGAA Publications 2140, the new 32-page edition contains two new methods, "LPG Corrosion Test" and "LPG Sampling Method," and includes a former separate publication "LPG Specific Gravity Test (Hydrometer Method)." All tests have been considerably revised to give them greater accuracy and duplicability and to make them more useable. Some of the more noticeable changes are in the apparatus used in the vapor pressure, propane residue and weathering tests. For vapor pressure testing an adaptation of the Reid bomb proved to be the most practical after experiments with several other types.

Principal changes in the LPG specifications are: vapor pressure specified as 215 lbs., at 100F., instead of the old 225 lbs. at 105 F., and replacing of the old "Sulfur Content" specification with "Total Sulfur" and "Corrosive Compounds" specifications. Other revisions are largely editorial.

The new publication is available at NGAA offices, 422 Kennedy Bldg., Tulsa 3, Oklahoma, at $1.00 per copy.

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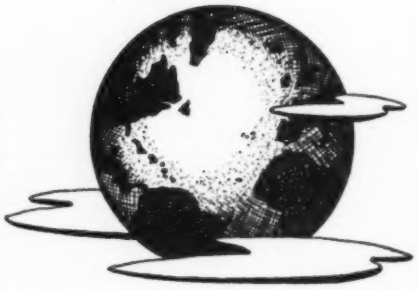

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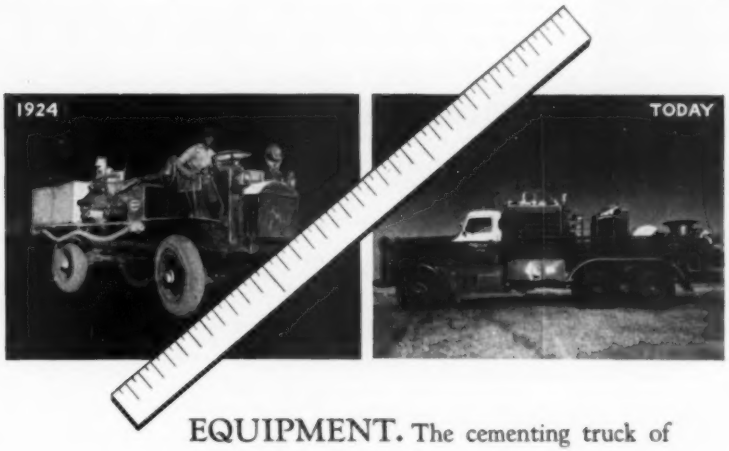


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# Oil company staff changes

William G. Taylor

**WILLIAM G. TAYLOR** has been promoted to assistant manager of the purchasing department of The Texas Co. Mr. Taylor has spent his entire business career with Texaco, having entered the company's service in 1922 as a mail boy in the New York offices. He has been in the purchasing department since 1925. From October, 1947, until last November he was divisional purchasing agent for the company in Chicago.

**M. E. MICHAEL,** development foreman of Phillips Petroleum Company's Gulf Coast production division, has been appointed district superintendent at Beaumont, Texas, succeeding H. M. Bell, resigned.

**DAVID S. KILGOUR** retired on July 1 as secretary of Western Oil and Gas Association. He joined the association, then known as the Chamber of Mines and Oil, in 1925, as an auditor and became successively assistant secretary and secretary, the post he held at time of his retirement. For 11 years, from 1933 to 1944, he was also secretary of the Pacific Coast section of the division of production of the American Petroleum Institute and is currently on its advisory committee.

**BRANDON H. GROVE,** formerly of the producing department, Socony-Vacuum Oil Co., Inc., has been named general manager of Socony-Vacuum operations in Egypt and the Red Sea to succeed Robert S. Stewart, retired.

After starting with Socony-Vacuum in 1935, Mr. Grove spent the succeeding four years in the company's European offices. He returned to the United States in 1940 for a training period with Magnolia Petroleum Co., and then went to Spain and Colombia. He was on loan to the Foreign Economic Administration from April, 1943, to July 1946, and was in Europe for Socony-Vacuum from 1946 to July, 1949, when he returned to Socony-Vacuum headquarters in New York. He was transferred to the Cairo, Egypt, office in early 1950.

**R. S. CAREY,** general manager of Burmah Oil Co. at Rangoon, is in England on home leave. While he is away from his post C. Maxwell-Lefroy is acting general manager.

**J. W. HUDSON** has been appointed general superintendent of Deep Rock Oil Corporation's crude oil production to succeed Carl A. Houy, who recently was elected production vice president. Mr. Hudson formerly was superintendent of the oil and gas division of Republic Natural Gas Co.

**R. I. WILLIAMS** has been named assistant general superintendent of crude oil production for Lion Oil Co. He has been superintendent of the southern division and will be succeeded in that post by A. W. Wood, recently with the production department of Phillips Petroleum Co.

**THOMAS E. MONAGHAN,** an attorney with Standard Oil Co. (N.J.), has been elected a director of Esso Export Corp. He has been a member of Jersey Standard's legal staff for the past five years and previously was counsel for Pan American Petroleum and Transport Co. and served as a director of The American Oil Co. and Mexican Petroleum Corp.

**AS A STEP IN THE DECENTRALIZATION** of Shell Oil Co. exploration and production activities, four new regional vice presidents have been elected. They are J. T. Dickerson, Midland, Texas; W. A. Alexander, Tulsa; Bouwe Dykstra, New Orleans and E. G. Robinson, Calgary. A new exploration and production technical service group was organized in Houston headed by Dr. Harold Gershinowitz who was also named vice president.

Also announced at the same time was the promotion and transfer to New York from Houston of R. W. Bond, who becomes manager, head office production, and F. A. Nelson, who was named manager, head office exploration. They will assist A. J. Galloway, Shell's vice president in charge of all exploration and production activities.

**JAMES F. DRAKE, JR.** has been appointed assistant to the vice president, production development and product engineering, for the Gulf Oil Corp. In his new position, Mr. Drake will correlate and coordinate activities between the vice president and all sections of the department as well as with the manufacturing, sales, and research departments.

**WARREN A. SINSHEIMER,** vice president of Petroleum Advisers, Inc., a Cities Service affiliate, has been appointed petroleum economics coordinator, a new company activity. Under his direction, broad economic studies within the petroleum industry as well as those of a general nature will be made, and the long-range growth plan of petroleum subsidiaries and departments will be coordinated for consideration by the chief executive officers and directors of Cities Service Co. Mr. Sinsheimer joined Cities Service in Oklahoma in its production and engineering department in 1917. For a number of years he was manager of the oil production and crude oil transportation department.

Warren A. Sinsheimer

Amos A. Roberts

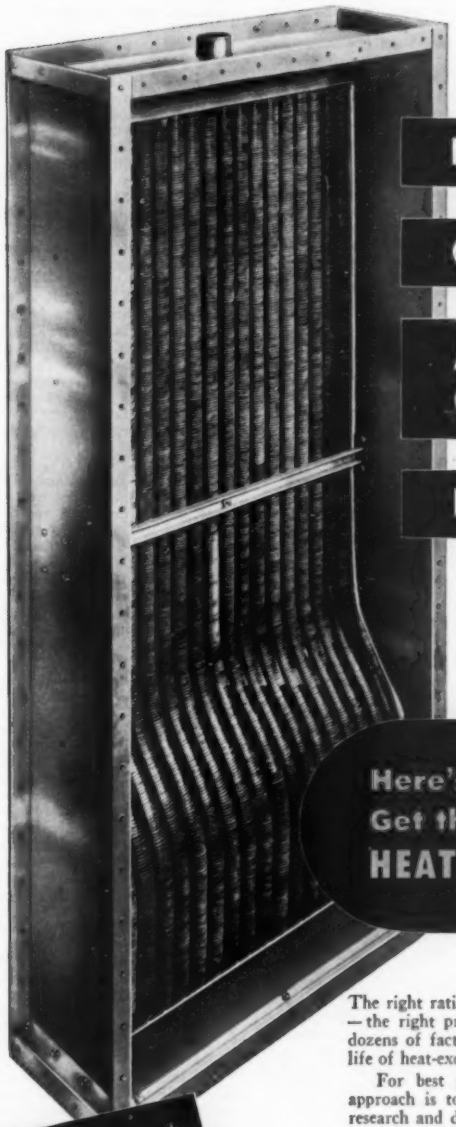
**AMOS A. ROBERTS,** former manager of the Mid-Continent division, has been appointed general sales and service manager for Baroid Sales Division of National Lead Co. Mr. Roberts, a graduate of Oklahoma A & M, joined Baroid in May, 1935, as a field service engineer in the Mid-Continent division. In 1943, he became district manager in the Mid-Continent and shortly thereafter became manager of the Mid-Continent division. In his new capacity, Mr. Roberts will exercise direct supervision over those divisions and departments of the Baroid Sales Division which are engaged in sales and service of drilling mud products.

**V. G. BARTRAM,** of Montreal, president of Shawinigan Chemicals Ltd., has been elected president of B. A.-Shawinigan Ltd., the newly-organized petrochemical company owned jointly by the British American Oil Co. Ltd. and Shawinigan Chemicals Ltd. Vice president of the new company is M. S. Beringer, of Toronto, British American's vice president in charge of manufacturing. The company will invest between three and four million dollars in a plant near the present British American refinery in Montreal East for the production of phenol and acetone. The Canadian Kellogg Co. Ltd. of Toronto is engineering and building the new plant, which is expected to be in production by late next year.

**L. E. FITZJARRALD,** general superintendent of production for Phillips Petroleum Co., has been appointed manager of the production department. H. H. Kaveler, assistant to the vice president, has been appointed assistant manager; and J. M. Houchin, assistant general superintendent, has been appointed general superintendent. C. P. Dimit, vice president and director of Phillips, will continue as vice president in charge of production.

Mr. Fitzjarrald, who joined Phillips in 1919, has been general superintendent since 1944. He has served in the production department since 1922 when he was appointed chief clerk. Mr. Kaveler started with the company in 1936, as assistant section chief in the production department. He became assistant to the vice president of production in 1944. Mr. Houchin joined Phillips in 1933. He has served continuously in the production department, having been appointed assistant general superintendent in 1944.

**FREDERICK H. MEEDER** has been elected president of the Richfield Oil Corp. of New York succeeding Marc F. Braeckel who resigned to become vice president of the Sinclair Refining Co. Mr. Meeder came to Richfield from the Walburn Petroleum Co. Inc. in 1929. H. G. Meyers and R. F. Glock were elected Richfield vice presidents.



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H. H. Arnold, Jr. H. C. Hose

**HAROLD C. HOSE** has been named assistant to executive vice president A. C. Long of The Texas Co., and H. H. Arnold, Jr. has been appointed manager of foreign operations (Eastern Hemisphere). Mr. Hose has been with Texaco since 1927. He has held various positions in the refining department and has been associated with the company's foreign operations since 1944.

Mr. Arnold also entered the company's service in 1927, in the geophysical department. After a period of service in World War II, he returned to Texaco in 1946. Last November he was named assistant to the manager of the producing department at Houston. Both men will make their headquarters in New York.

**J. EDGAR HESTON** has been appointed manager of oil production of Cities Service Co., to succeed Warren A. Sinsheimer, recently appointed petroleum economics coordinator for the company. Mr. Heston has filled various key positions in geological and oil production departments of Cities Service companies since 1931. From 1941 to 1945 he served as assistant director of production of the Petroleum Administration for War. Upon the completion of this service, he became assistant manager of the oil production department of Petroleum Advisors, Inc.

**J. R. McWILLIAMS,** executive vice president and a director of The Carter Oil Co., has been appointed deputy coordinator of the world-wide producing activities of Standard Oil Co. (N.J.). He resigned his post with Carter at Tulsa on July 16. Mr. McWilliams joined Carter in 1934. Two years later he was elected a vice president and director of Standard Oil Co. of Louisiana where he was in charge of producing operations for five years. He rejoined Carter as a director and manager of its production department in 1941 and in 1944 was elected a vice president. While on a year's leave of absence, during 1945, Mr. McWilliams served as director of the producing division of the Petroleum Administration for War and later became executive vice president of Carter.

**M. A. WRIGHT** has been elected executive vice president of International Petroleum Co. He has been deputy coordinator of all producing activities of Standard Oil Co. (N.J.) since November 1949. Mr. Wright's first job in the oil business was that of junior engineer for The Carter Oil Co. in the Seminole field in Oklahoma. He became chief petroleum engineer in 1943 and assistant manager of the production department the following year. Early in 1946, Mr. Wright became an executive assistant in the producing coordination department of Jersey Standard, and deputy coordinator of producing activities in Nov. 1949. In this capacity he spent considerable time dealing with foreign as well as domestic producing problems for Jersey Standard.

## Buys Producing Companies

J. D. Sterling, president of the Sunset Oil Co. and the Eagle Oil & Refining Co., Inc., has announced the acquisition by his group of controlling interest in the Mission Oil Co., Padre Oil Co. and Real Oil Co. These three companies hold leases on approximately 570 acres of the Raisin City field in Fresno County, Calif., and are presently producing 40,000 barrels of oil monthly.

## Sohio Prospecting in Canada

The Standard Oil Co. (Ohio) has acquired rights on extensive Canadian oil and gas acreage through a farm-out agreement for exploration and drilling on 2,400,000 acres of crown permit land in the province of Saskatchewan. The company has five drilling rigs operating in the area. One of these is the heaviest ever to be used in Saskatchewan and capable of drilling to 15,000 feet. The Sohio area includes 400,000 acres in west-central Saskatchewan, about 50 miles from the Alberta line; plus 2,000,000 acres in the northwest portion of the Williston basin and along the international boundary, and several scattered areas.

This agreement covers a part of the 8,400,000 acres of government land and 1,500,000 acres of leased land on which Sohio Petroleum Co. is now the operator for a "joint venture group" comprised of itself and six other companies; Texas Gulf Producing Co., Midstates Petroleum Corp., Union Sulphur & Oil Corp., The Chicago Corp., Bradley Producing Co., and Republic Natural Gas Co.

A second farm-out by the joint venture group is to Socony-Vacuum Oil Co., covering approximately 400,000 acres lying north of and adjoining Standard's. The third farm-out is to a group of independent operators including McCarty & Coleman, Fain & McGaha and J. S. Bridwell of Wichita Falls, Texas, which will cover by geophysical exploration approximately 400,000 acres along the International Boundary.

Stanford L. Myers

## Joins Southern Geophysical

Stanford L. Myers, who was with Stanolind Oil & Gas Co. for more than nine years, has been appointed equipment and safety supervisor of Southern Geophysical Co. with offices in Fort Worth and Midland, Dr. Sidon Harris, president of Southern, has announced. Myers is based in the Fort Worth office and is in charge of all equipment of Southern Geophysical Co., which at the present time is operating in eight states. He also supervises the continuing safety program of the Southern Geophysical Co. crews.

## To Build Two Hydroforming Units

Cities Service Oil Co. has authorized The M. W. Kellogg Co. to design two fluid hydroforming units. One will be located at Lake Charles, La., the other at East Chicago. Capacity of the Lake Charles unit will be 20,000 barrels daily and the Chicago unit 10,000 barrels.

## Ralph L. Boyer Wins Lamme Medal

Ralph L. Boyer, vice president and chief engineer of The Cooper-Bessemer Corp., Mount Vernon, Ohio, has been awarded the Lamme Medal, one of Ohio State University's highest honors. The 1951 awarding of the Lamme Medal was made to Mr. Boyer for the development of today's important gas-diesel engine and the high compression spark-ignited gas engine.

## Joins Timken Advertising Staff

Bob Wagner, who has been narrating and writing The Timken Roller Bearing Company's "Message to Americans" radio program, has joined the advertising department at the Timken plant in Canton. He assumed his duties as manager of the news bureau and related public relations work on June 25.

## Crawler Catalog

Data on the International TD-9 diesel crawler tractor is contained in a 32-page, two-color catalog just released by the International Harvester Export Co. This four-cycle, four-cylinder crawler, available in two gauge widths, 44 and 60 inches, has a drawbar horsepower of 40.5. Improved design features of the engine increase its power to 51.5 hp at only 1,450 rpm. Copies of E-62-A catalog are available upon request from Merchandising Services, International Harvester Export Co., 180 North Michigan Ave., Chicago 1, U. S. A.

**R. G. "DICK" REESE,** chief of exploration for Arctic Contractors, has joined Hudson's Bay Oil and Gas Co. Ltd., as chief geologist. Mr. Reese has previously done field geological work in Mexico and California for major oil companies. He had served with Arctic Contractors for the past year and a half, exploring and developing the United States Navy Petroleum Reserve in the Point Barrow region of northern Alaska.

**HENRY B. WILSON, JR.,** has been elected a director of International Petroleum Co., effective Sept. 1, 1951. He has been assistant manager of the employee relations department of Standard Oil Co. (N.J.). Mr. Wilson joined Humble Oil & Refining Co. as a student engineer and was transferred to Buenos Aires with the Standard Oil Co. S. A. Argentina, as employee relations manager in 1936. Later he was transferred to the Standard Oil Co. of Venezuela in a similar capacity. In 1941 he came to the employee relations department of Jersey Standard in New York.

**L. F. ATHY,** manager of the geophysical department of Continental Oil Co. has been promoted to manager of the exploration department. J. A. Culbertson, chief geologist, was promoted to assistant manager of the exploration department. He retains his position as manager of the geological section. H. R. Prescott, assistant manager of the geophysical department, was promoted to manager of the geophysical section.

Dr. Athy, who received his Ph.D. degree in geology from the University of Chicago, has been associated with Continental for more than 26 years. He joined the company as a geologist in 1925 in Ponca City, Okla. He became chief geophysicist in 1936 and manager of the geophysical department in 1948.

Dr. Culbertson received his Ph.D. degree in geology from the University of Illinois and joined Continental in 1933. Rising to division geologist in the Houston division, he was promoted to assistant manager of the geophysical department in 1948 at Ponca City, and named chief geologist in 1949.

Mr. Prescott joined Continental as an engineer in 1928. He was promoted to assistant chief geophysicist in 1939 and moved up to chief geophysicist in 1948. He became assistant manager of the geophysical department in 1949.

J. A. Culbertson L. F. Athy H. R. Prescott

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## Sinclair Remodels Tanker

The S. S. Sinclair Superflame has returned to the coastal trade as a combination bulk oil and dry cargo vessel after remodeling by Sun Shipbuilding and Drydock Co. She is unique in that she is the only completely air conditioned tanker afloat and is capable of carrying 14 different grades of lubricating oil in addition to 12 grades of clean products, such as gasoline, kerosine, home heating oil, solvents, diesel fuel and tractor fuel.

The tanker formerly had a cargo carrying capacity of slightly in excess of 94,000 barrels of products and 518 tons of dry cargo. She now has facilities for carrying 25,000 barrels of lubricating oils in the 14 tanks located in the forward part of the vessel and 54,000 barrels of clean products in the four main center and eight adjoining wing tanks aft. In addition, her dry cargo carrying capacity has been increased to 1900 tons.

To accomplish the conversion it was necessary to convert the center cargo oil tanks into a common dry cargo hold and fit two dry cargo hatches on the forward deck. Four new additional high speed winches and four additional three-ton booms were installed. The bulk oil cargo tanks adjacent to the new dry cargo hold were converted into the separate lubricating oil tanks.

A new cofferdam pump room was constructed just forward of midship completely dividing the vessel and eliminating the possibility of mixing of products. This pump room is equipped with forced ventilation supplied by steam turbine driven blowers and four new steam driven lubricating oil cargo pumps and a new conventional bilge pump. Each cargo pump has a capacity of 700 gallons per minute. In the original forward pump room three new 350 gallons per minute steam driven cargo lubricating oil pumps were installed, replacing the old pumps. In the after pump room an additional new 1,800 gpm pump was installed to supplement the three original 700 gpm pumps.

Two completely independent Cargo-cair e systems have been installed to control temperature and thereby prevent condensation due to change in outside temperature. Thus, deliveries of packaged goods and lubricating oils at the point of destination are received in the same condition as from the refinery. These units are located in the midship shelter deck space and are operated by steam driven units.

In the process of conversion, the foremast and main mast and the usual catwalk from the bridge house to the forecastle head were removed. King posts were installed at desired locations for dry cargo booms, and the pressure vacuum cargo tank ventilating systems. A new mast was installed on top of the wheel house to take the necessary range lights and the rotating antenna for new radar equipment.

With the addition of this converted tanker to the Sinclair fleet the company will be able to ship lubricating oils and refined products and dry cargo from its refineries at Houston and

*(Please turn to page 54)*

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Mexico—third largest producer of oil in the Western Hemisphere.
Mexico—third largest consumer of oil in the Western Hemisphere.
Mexico finds satisfaction in both these ratings.
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Domestic oil consumption has soared in recent years, and Petroleos Mexicanos has met the challenge: more than doubled the nation's total petroleum refining capacity since 1938—multiplied seven times the refining capacity in the central zone of the Republic where the principal demand exists.
Thus, in addition to being a net *exporter* of oil, Mexico progresses in meeting *internal* requirements and providing more oil and oil products . . . at home and abroad . . . for today and tomorrow.
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*(Continued from page 52)*

Corpus Christi, Texas, on the Gulf Coast, to terminals on the Gulf and the Atlantic Seaboard, discharging products on its northward voyage, and one arrival at the refinery port of Marcus Hook, Pa., reload with products to be delivered on the Southward trip, eliminating the necessity of returning in ballast. It is also anticipated that split cargo deliveries by the larger tanker will be entirely eliminated. With the new installations it is estimated the vessel will make a complete turn around in port in about eight hours and a round trip every 16 days. Conversion of the vessel was started on May 30 and completed July 15 at the yards of the Sun Shipbuilding & Drydock Co., Chester, Pa.

## To Increase Mid-Valley Line Capacity

Mid-Valley Pipeline Co. will spend $8 million to step up capacity on its 1,000-mile crude line from east Texas to Ohio. Six new booster pump stations, together with additional tankage, will increase from 155,000 bbls. to 235,000 bbls. per day the capacity of the 565-mile section of 22-inch line between Mayersville, Miss., and Hebron, Ky., with proportional increases in the sections from Longview to Mayersville and from Hebron to Lima, O. One additional pump unit (either diesel or electric motor) is also to be installed in each one of the existing main trunk line stations. A micro-wave communications facility will be installed at each new booster station.

The Mid-Valley line will connect with the projected "big inch" crude line from west Texas through a 20-inch spur from Wortham to Longview in east Texas, the southern terminal of the Mid-Valley line. Sun Oil Co. and The Standard Oil Co. (Ohio), joint owners of Mid-Valley, are also participants with Gulf Oil Corp., Cities Service, and Pure Oil Co. in a new pipe line which forms a link between west Texas oil fields and pipe line and port facilities in the eastern part of the state. It is expected that construction of this line will start early in 1952.

## Gulf Building Coastwise Tanker

A new 18,000-ton tanker for coastwise service has been ordered by Gulf Oil Corp. The new Gulf tanker will be 551 feet long with a beam of 68 feet and a depth of 37 feet, six inches and a cargo capacity of 150,000 barrels. It will be equipped with a multiple pumping system to preserve the integrity of the grades of products carried and to insure their rapid discharge at its port of call, in Gulf and Atlantic coastwise service.

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FACTORY BRANCHES: Baltimore 5, Birmingham 3, Boston 16, Buffalo 3, Chicago 5, Cincinnati 2, Cleveland 15, Dallas 2, Denver 4, Detroit 21, Glendale 1, Houston 6, Indianapolis 4, Kansas City 2, Minneapolis 2, Newark 6, New York 17, Philadelphia 23, Pittsburgh 22, St. Louis 3, San Francisco 7, Seattle 1, Tulsa 6, Washington 6.
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## Wildcatting Doubles in Rockies

Wildcat wells were drilled to a combined total depth of 729,913 feet during the first six months of 1951 in the Rocky Mountain oil region, according to the mid-year report of Petroleum Information, Rocky Mountain oil statistical and information firm of Denver and Casper. This compares with 354,840 feet drilled during the same period a year ago. The number of wildcat wells, 146, represents 66 percent more wells than during the first six months of 1950. Geophysical prospecting, leasing, wildcat and development drilling have reached an all time high.

## Oil Company Reports

Production of oil in Iran reached a record figure of 32 million tons (over 675,000 barrels daily) during the past year. Production from Kuwait, in which Anglo-Iranian has a half interest, increased nearly 40 percent during the past year and is now proceeding at the rate of 25 million tons per year (roundly 530,000 barrels daily). Directors of Anglo-Iranian have decided to maintain the company's dividend at 30 percent by declaring a final payment of 25 percent as has been the case since 1946. Presentation of the annual report and accounts has been deferred owing to present conditions.

The report of Burmah Oil Co. Ltd., covering operations during 1950, shows a successful year in spite of the fact that production and refinery operations in Burma have been severely restricted. Profits rose from £2,681,942 to £2,891,458 ($8,096,082). With £547,851 carried forward the amount finally available for disposal was £3,439,309 ($9,869,865).

This has been disposed of by the payment of total dividends of 15 percent plus a cash bonus of six percent, with an allocation of £1,203,332 to general reserve, leaving £547,941 ($1,590,235) to be carried forward.

About one-third of Burmah's requirements in the areas available for distribution were supplied by indigenous products, and hopes are entertained that with increasing security and improved economic conditions this percentage will be increased. Security conditions are however not yet stable enough to justify repair of the main pipe line and completion of the Syrian refinery.

The annual report of Shell Transport and Trading Co. Ltd. is a very pleasing document from the shareholders' point of view, in that the net profit for the year 1950 was £6,438,477 ($18,027,735) being over £1,600,000 ($3,480,000) more than the previous year. The amount distributed to the ordinary shareholders has risen by just over £2,180,000 ($6,104,000), with a carry forward of unappropriated profits slightly larger than the previous year.

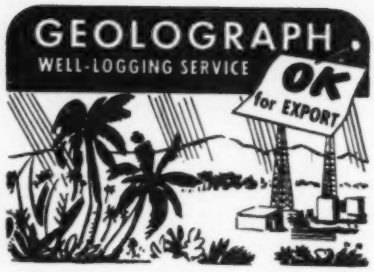
## Lubrication for Steam Turbines

A new publication has been issued by Shell Petroleum Co. Ltd. on the lubrication of steam turbines. Its 129 pages of text and diagrams form a comprehensive guide to the lubrication of this class of plant, both from the mechanical and the oil side. The illustrations and descriptions of the various types of equipment and lubricating systems are indexed in such a way as to permit them to be easily followed.

## Book Review

The Woodbine and Adjacent Strata of the Waco Area of Central Texas; a symposium edited by Frank E. Lozo and Bob F. Perkins; published 1951 by Southern Methodist Press, Dallas, Texas; 161 pages of text, with index, numerous maps, charts and plates, cloth $7.56, paper $6.25.

This interesting volume was sponsored by the East Texas and the Shreveport Geological Societies with the support of numerous interested persons and firms and is especially designed to illustrate field trips through the area. The history of the discovery and development of the Woodbine oil fields (East Texas Field) is described and the various subdivisions thereof are explained in detail. It is perhaps the most attractive account of this famous oil reservoir that has yet been printed in book form.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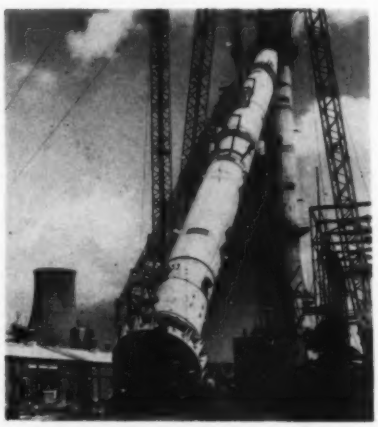
TIME WILL TELL
THE GEOLOGRAPH CO. INC


## Shell's Stanlow Refinery

The second crude distillation unit at the Stanlow refinery of Shell Petroleum Co. Ltd. came on stream in mid-June, and trebles the crude capacity to over 3,000,000 tons per year. This brings Shell's refining capacity in western Europe to about 20,000,000 tons per year, of which over 6,500,000 tons is located in Great Britain, in the refineries at Shell Haven, Stanlow, Heysham and Ardrossan.

Five further units which are in an advanced stage of construction are still to come into operation at Stanlow, including a catalytic cracking plant. On completion this refinery will produce a complete range of refined petroleum products, from high grade petrol to heavy fuel oil, as well as refinery gases as raw material for use in its chemicals-from-petroleum operations.



**240 ton welded steel absorber column being raised into position at Stanlow refinery.**

During the month, what was perhaps the heaviest lift in a refinery in the eastern Hemisphere was made when a welded steel absorption column weighing 240 tons, with dimensions of 170 feet high and 10 feet diameter, was raised into position. It was delivered to the works in three sections as the complete column would have been too long for road or rail transport, and the sections were welded together on site prior to erection. The column was built by Babcock and Wilcox at their Renfrew Works in Scotland.

PETROLEUM CHEMICALS DIVISION
# NEWS

August ★ One of a Series of Interest to the Petroleum Industry ★ 1951

## Brakes Relined with a 'BANG'

New Du Pont explosive rivets save time and money in relining brakes. This saving is especially important to operators of heavy-duty trucks that give brakes real punishment.

Formerly, relining necessitated removing the brake shoes, riveting on new linings, and reinstalling them. Now, in most cases, the job can be done with Du Pont explosive rivets without removing the brake shoes from their anchor plates. The saving is about 50 per cent of the former over-all cost of replacing linings.

And explosive rivets outperform conventional rivets set by hand, as proved by dynamometer tests. Also, road tests show that linings fastened the new way are free from objectionable "brake squeal." It means more time on the road and less time in the shop for equipment regularly hauling loads on a 'round-the-clock schedule.

## Du Pont 'Alamask' Odorants for the Petroleum Industry

The ability to smell is one of the five senses on which we depend for knowledge of our environment. Because a vast number of things are slightly volatile, they betray their presence and character by odor in the air we breathe. This is particularly true with many products derived from petroleum.

Recently the Du Pont Company, working with petroleum technologists, developed a line of "Alamask" odorants which are finding application by the petroleum industry. These odorants are generally designed to impart a clean odor without resorting to floral, sweet, or fruity perfuming. They serve well in covering the intense odors of some grades of mineral spirits, or the sulfurous odors which may be present in various types of cutting oils. Some grades of spray oils and heater oils, which have objectionable odors are improved by the addition of the proper "Alamask" odorant.

The Du Pont "Alamask" odorants for petroleum products are oil soluble. They possess high odor coverage values. As little as one pound of a selected "Alamask" was reported valuable in reodorizing nine thousand gallons of #2 type fuel oil. In another instance, one pound of "Alamask" gave a neutral odor to seventeen thousand gallons of selected thinner.

"Alamask" odorants are designed by Du Pont's Fine Chemicals Division to give better sales appeal to petroleum products at low cost. The odor of a petroleum product, when pleasant, may prove of considerable sales value.

# Du Pont Gives Representatives Thorough Training to Assist Refiners

### TAILOR-MADE PROGRAM COVERS MANY MONTHS

How can a Du Pont Field Representative be most helpful to refiners and marketers of petroleum products? That question led to the development of an intensive training program in the Petroleum Chemicals Division.

Trainees receive much valuable instruction in lecture rooms as a supplement to practical experience gained in TEL manufacturing areas, in laboratories and in the field.

As a result, when a Du Pont representative calls at your refinery or marketing office, he is prepared to help you solve many problems concerning TEL and other petroleum additives. His services also include merchandising aids intended to supplement your own marketing program.

To prepare prospective representatives for this important work, each goes through a specialized training program, lasting from 6 months to a year. Each prospect is carefully selected for the job. Almost all hold engineering degrees. Many have had years of actual refinery experience. The training program is adjusted to meet the individual requirements of each man.

First of all, the new prospect goes to work in the main office at Wilmington. As he progresses he studies technical literature . . . familiarizing himself with all phases of the development, manufacturing, safe handling, distribution and application of tetraethyl lead compounds and other additives.

To thoroughly learn the TEL manufacturing process, the trainee spends considerable time in the manufacturing area. Step by step, he studies each phase of manufacturing. He works on quality-control problems, practices safe handling, helps at the furnaces, studies the ethylation process. He even becomes familiar with shipping details.

At-the-plant work in the manufacture of dyes, grease stabilizers and antioxidants is also part of his program. He gets a thorough background on raw materials, processes, and equipment used.

Safety is stressed throughout the training period. Each man becomes qualified to supervise tank entries and tank car unloadings. He also masters the safe technique for handling TEL in drums. So thorough is a Du Pont representative's safety background that he is able to render valuable service to refiners in helping to train their own blending personnel.

To gain a well-rounded working

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OVER

PETROLEUM CHEMICALS DIVISION
# NEWS

CONTINUED

## Thorough Training

knowledge of the Du Pont research activities helpful to refiners, each trainee participates in the work under way at the Petroleum Laboratory. The trainee is also given a brief indoctrination course in refinery processes.

Working with the sales promotion department, the trainee learns how to best apply his knowledge to the varied problems of individual refiners and marketers. How to demonstrate fuel performance with a test car . . . how to make dealer meetings successful . . . these are but a few of the services he learns to perform. Two weeks spent in the New York Office familiarize him with district office operation.

Direct knowledge of the customer's own operations is important, too. Traveling with an experienced representative, the trainee has the opportunity to meet refinery personnel and discuss their work with them.

Through this program, Du Pont is constantly increasing the manpower behind its services . . . making it more valuable to refiners and marketers.

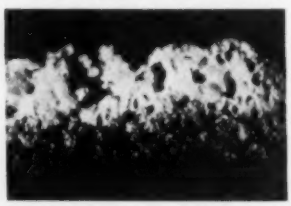
## Supervisor of Operations also Directs Instruction of Trainees

In addition to being supervisor of operations for the Petroleum Chemicals Division, B. Gardner Crane directs the trainee instruction program. Gardner Crane came with Du Pont in 1946 after thirteen years with the Ethyl Corporation. With Ethyl's Chicago Division he acted as sales promotion engineer and chief safety engineer. In New York he was in charge of engineering in the safety department. Previous to this, from 1930 to 1933, he was engaged in sales and engineering work for the Acoustical Engineering Corporation in Milwaukee, Wisconsin.

## New Data on Engine Deposits Presented by Du Pont Engineer

"Possible Mechanisms By Which Combustion Chamber Deposits Accumulate And Influence Knock" is the title of a paper presented at the SAE Summer Meeting at French Lick, Indiana by L. F. Dumont of the Du Pont Petroleum Laboratory.

It is thought that the new data presented by Mr. Dumont on knocking tendency caused by the volume, catalytic and thermal insulating effects of deposits will be of particular interest to refiners.



This figure appears in the paper, "Possible Mechanisms By Which Combustion Chamber Deposits Accumulate And Influence Knock." In the paper it is reproduced as a cross-section, 50 times enlarged, of piston top deposit showing a new technique for examination and evaluation of the effect of combustion chamber deposits on knocking characteristics.

In this connection, on the basis of the research reported in the paper, the increase in compression ratio caused by deposit volume accounts for approximately 20 to 40 per cent of engine octane requirement increase, depending on the engine type and type of deposits. It was also indicated that catalysis may not be a contributing factor, especially for leaded fuel deposits, although considerably more work will be required to confirm these results. The thermal insulating effect of deposits appears to be one of the major causes of deposit knocking harm.

Copies of the paper are available through your nearest Du Pont Petroleum Chemicals Division District Office.

## LITERATURE AVAILABLE

The Petroleum Chemicals Division of Du Pont has published a wide variety of material of interest to the petroleum industry. This includes technical papers, bulletins, reports and memoranda as well as equipment operation bulletins, safety regulations, tank cleaning data, marketing aids and the like.

Any of this is available on request to your nearest Du Pont Petroleum Chemicals Division District Office. A partial listing of available material is shown below:

Possible Mechanisms By Which Combustion Chamber Deposits Accumulate And Influence Knock . . . . . Serial A-2087a

Tank Talk—A new 52-page booklet designed for easy reading by tank cleaning personnel . . Serial A-1134

Blending calculator for Du Pont TEL Compound (Aviation Mix) . . . . . Serial A-1210

Exhaust Valve Rotation — A resume covering the use of mechanical devices to improve valve life . . . . . Serial A-656

The Effect of Hydrocarbon Structure on the Road Antiknock Performance of Motor Fuels . . . . . Serial A-505

Working with the Petroleum Industry —information about Du Pont's TEL manufacturing and research facilities . . . . . Serial A-8620

Antiknock Antagonists—by H. K. Livingston, Jackson Laboratory.

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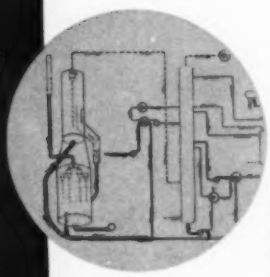

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# Two Thirds of Austrian Oil Moves to U.S.S.R. As War Reparations

By Frederick H. Baer

Hundreds of armed guards patrol the Austrian oil fields to prevent sabotage. Photo from Three Lions.

LATEST information from Vienna sources puts the 1950 Austrian crude oil production at 1,500,000 tons (about 28,500 barrels daily). The higher output was achieved by the use of special methods including compressed air rather than by discovery of new reserves.

While in 1950, the Austrian government claimed a minimum requirement of 600,000 tons of oil products, the Russians permitted only 535,417 tons to remain in the country, the rest, 62,000 tons (or nine percent) of the requirements, had to be imported. The amount of crude oil and refined oil products delivered to the Red Army and the Soviet satellites is almost one million tons, or two-thirds of the production.

The monetary loss to Austria, in 1950, by exporting this million tons of crude oil and refined products as reparations without reimbursement is said to be about $140 million.

When the Red Army entered Austria in April 1945, the oil fields, discovered and explored in 1930 by Austrian, British, and Dutch companies, had a normal annual output of 700,000 tons a year. During World War II, production was raised and by 1944 reached 1,200,000 tons. In 1945, when the Russians took over, they removed equipment worth $25 million. The remaining machinery was, however, in good shape, and production for the Soviets started immediately.

Under the Potsdam agreement, the Soviets were given all rights to German assets in Eastern Austria, Hungary, Bulgaria, and Finland. The oil fields located in the province of lower Austria became part of the Soviet occupation zone. While the Soviets found ten drilling areas in their zone, ranging from 100 to 2,000 acres in area, seven refineries, and two natural gas fields, the western powers at the same time gained control of only one small oil field, with a 600-barrel-a-year capacity, and one refinery at Ebensee, Upper Austria, in the US zone.

Claiming the oil properties as German assets, the Soviets soon had established the Soviet Mineral Oil Administration, the Austrian office of the Soviet Naphtha Ministry in Moscow. From this time on the Austrian oil fields were declared extraterritorial, and no control by the Austrians or by the Western Powers was permitted. The SMOA, part of the USIA organization, the Administration for Soviet properties in Eastern Austria, transfers all profits to this organization as reparations payment from Germany.

Beginning in early 1946, the three Western Powers tried to secure Russian approval in declaring the oil fields "inappropriate for reparations", since the pre-German owners

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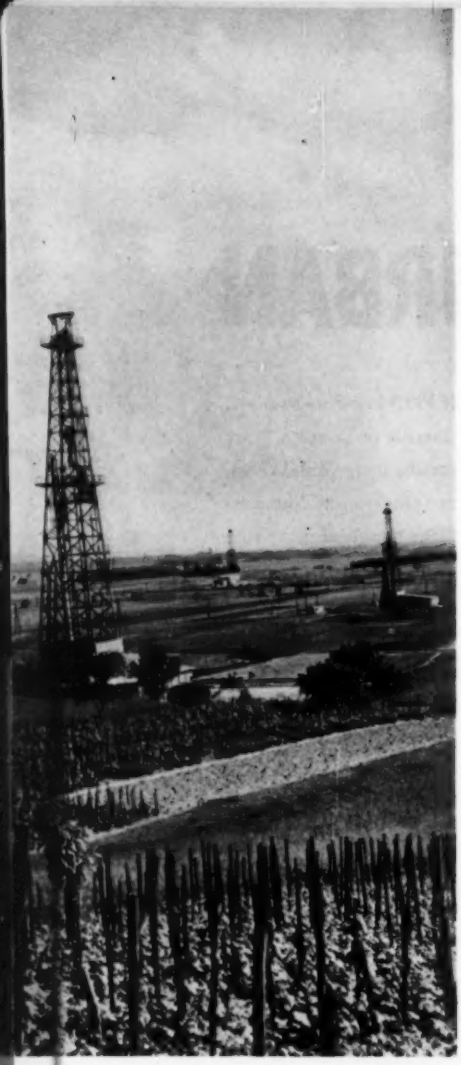
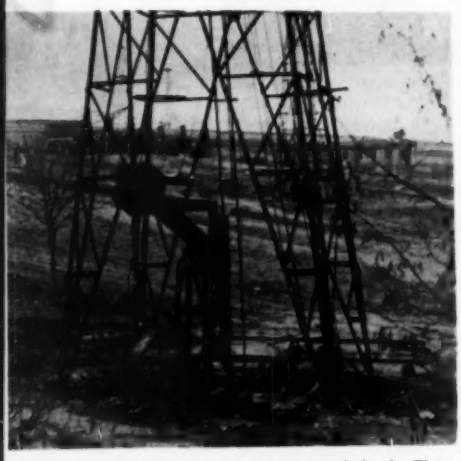


The recently discovered Matzen field is now producing around 100,000 tons of oil per year. Much of the drilling in this field is done by Czechs from Skoda. Black Star photo.



Electrically operated pumping unit in the Zistersdorf area. Photo from Three Lions.

were, at least in part, nationals of the United Nations. Russia refused agreement on this basis, claiming title to the German capital investments and interests.

The Austrian Government was likewise unsuccessful in attempts to persuade the Soviet High Commissioner for Austria to transfer the oil fields to Austrian trusteeship, as the Western Powers had done with German assets in their occupation zones.

Russia, in turn, offered a 50-50 split of the rights and the profits to the Austrian Government, if it would agree on a combined or cooperative operation of the fields for an indefinite period. The Austrian Government, recognizing the danger of such an agreement, refused to sign.

The future of the Zistersdorf oil fields still is dubious. Under the present interpretation of the draft of the Austrian State Treaty, Zistersdorf oil does not fall under the paragraph ordering restitution of some 330 industrial and 140 agricultural units designated as German assets, in return for a payment to the Soviets of $150 million, about 65 percent of a year's budget for the Austrian Federal Republic.

In 1945, when the Allied troops entered Austria, the Germans had destroyed part of the oil field equipment, and had removed some machinery. The Russians then dismantled and shipped to the East machinery, particularly drilling equipment, worth over $25 million. Beginning with a production of 6,500 tons per month in May, 1945, the output increased regularly, reaching 77,000 tons in December 1947. Since then, the production has risen only slightly. While the Zistersdorf output continued to equal the 77,000-ton production in 1947, a newly-discovered field at Matzen, also in the Soviet zone, brings in almost 100,000 tons per year.

Recently the Soviet Mineral Oil Administration announced that it has discovered an additional oil field in Lower Austria, and started its exploitation. The newly-discovered oil field lies in the region of the village of Bockfliess, some 20 miles northeast of Vienna. Oil has been located in two places, "Bockfliess I" at a depth of 760 feet, and "Bockfliess II" at a lesser depth, and from a level which is presumed to be the same as that of the large neighboring oil field of Matzen, 25 miles northeast of Vienna.

The right to search for and drill for petroleum in the Soviet zone of Austria is exclusively Russian. During 1949, the SMOA had located a new field at Matzen, estimated to serve for 30 years before depletion, at a yield of 100,000 tons per year. But forced production and generally low-standard machinery and management will very possibly deplete the field within the next 12 years.

All data concerning petroleum—its production, export, delivery, cost, number of workers employed, etc. are top secret with the Soviets. Heavily armed, especially trained Austrian Communists guard the fields closely. Special food, good pay, extra clothing, and other privileges render the guard jobs desirable.

The delivery of the Soviet-controlled oil to the Austrians is very irregular both in quantity and delivery date; delivery has never, since 1945, reached consumer requirements, not even the agreed Russian allocations. The Austrian government listed a minimum requirement of 23,000 tons per month in 1947, and the need had risen to 32,000 tons monthly by 1951. The Soviets allocated 35 percent of the minimum gasoline requirement, and 60 percent of the kerosine, 52 percent of the diesel fuel requirement, and 48 percent of the lube oil, while high-octane gasoline allocations were only 19 percent of requirements, and bitumen 24 percent. The average of these allocations in relation to requirements is 56 percent. The allocations were met up to 98 percent in 1947, which was the highest point ever achieved.

In 1947, the crude oil production was 927,564 tons; 250,730 tons were shipped immediately to Eastern Germany and Czechoslovakia, and were there used by the Red Army. In that year, 672,302 tons were transported to the refineries, from which, after a refining operations loss of six percent, and a working loss of four percent, only 350,515 tons were dispatched to the Austrian government, while 258,053 tons were shipped out of Austria by the Russians. These figures demonstrate that 27 percent of the crude oil was withheld or exported by the Soviet MOA, as well as 43 percent of the refined products.

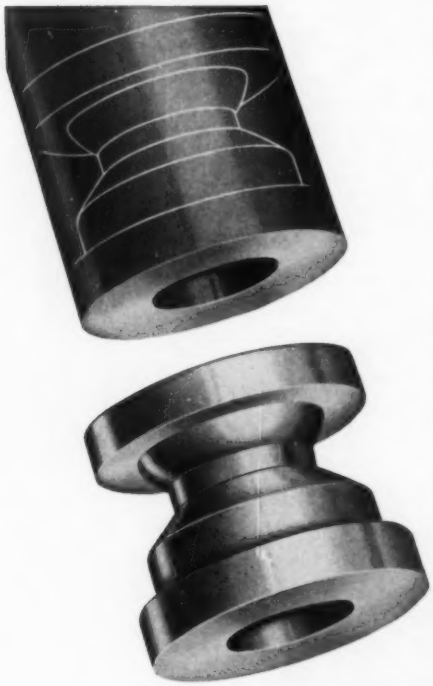
Seven refineries are located in the Soviet zone, five of them are Russian-operated, while the two remaining ones are in the hands of private companies. Their capacity, 840,000 tons annually, ranges from 2,500 to 5,600 barrels daily. Only one smaller-sized refinery is located at Ebensee in the US zone of Austria, province of Upper Austria, turning out 2,200 barrels daily.

For handling distribution, the Soviets have established a Soviet-Austrian company, which enjoyed monopoly status both as to distribution and supply of all gasoline stations in the Russian zone. The OROP Company is one of the few which pays taxes. (90 percent of the other Soviet firms in Austria pay not at all, or only in part.) Many United States war surplus cars, Jeeps, Dodge trucks and GMC tank wagons, are in use by the OROP Company.

To cover the gap in supply of oil products in Austria, the difference between Soviet deliveries and actual requirements is made up by importing supplies from the Near East, chiefly via Italy. Due to the shortage of foreign currency, compensation agreements have to be made, receiving the oil products in exchange for Austrian wood, iron or magnesite, of a value of approximately $12 million annually.

In order to distribute gasoline and lubricants equitably to consumers, according to their importance to the country's economy, rationing has had to be continued. About 12,000 vehicles were licensed in Austria in 1945. Gasoline vehicles received about two to ten gallons and diesel vehicles between five and 25 gallons of that fuel per month. All lubricants, bitumen, asphalt, etc. were strictly rationed. Until 1947, the gasoline price was officially set at 1.30 schillings (at a period of an official relation of ten schillings to one United States dollar, and a black market relation of from 100 to 150 to the dollar). Since 1945, the Soviet MOA has raised the official price to 1.80, then to two schillings a liter. In 1950, the Soviet MOA raised its delivery to the Austrians considerably; 21.3 percent more gasoline, 95 percent special gasoline, 20 percent more oil, 41 percent bitumen, and 200 percent more fuel oil. Imports are, however, still necessary, and Austrian users have to pay half a schilling (two cents) more for every liter to cover a part of the import expenses.

# How hollow-parts makers can save steel now



BY using Timken® seamless steel tubing instead of bar stock to make hollow cylindrical parts, you eliminate the drilling operation. This saves all the metal that's wasted in drilling a center hole in bar stock. You get more finished parts out of a ton of steel.

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# British Oil News

by E. Lawson Lomax

LONDON

The most prominent news topic and the subject most discussed in British oil circles this month naturally has been the Persian imbroglio. Due to the intransigeance of the Persian government and their refusal to consider any reasonable solution regardless of the disastrous effect of their course upon the economy of their own nation, the outcome of the situation is still impossible to predict at this writing. The only encouraging feature in the outlook is the joint action that is being planned by representatives of the international companies on both sides of the Atlantic to lessen the impact of a possible shutting off of Persian supplies.

## Electric Welders

Lincoln Electric Co. has supplied a number of welders with S.A.E. 300 amp. motor generators for use in the extensions of the Llandarcy refinery of the Anglo-Iranian Oil Co. Ltd., The photograph shows a load of these leaving Lincoln's Works, which are set amongst the lawns and trees of Welwyn Garden City.

## New Sulfur Plant for Britain

It is announced by Esso Petroleum Co. Ltd., that a third stage in its large refinery program at Fawley will be the erection of a plant for the manufacture of sulfur from the sour Middle East crude which the new refinery will process. The plant is scheduled for completion early in 1953, and is expected to produce 12,000 tons of practically pure sulfur per annum in excess of its own requirements, which will be available for other consumers. The production of such an amount of sulfur in a state of commercial purity will help to alleviate the shortage in Britain as it is equivalent to over 38,000 tons yearly of 96 per cent sulfuric acid, or about two percent of the country's requirements. Although the project has the benison of the government, it will be solely financed by the Esso Petroleum Co.

## Floating Filling Station

A floating filling station named the "Good Service" has been put into commission on the Thames by R. G. Odell Ltd., as agents for Shell-Mex and B.P. It is fitted with two 50-ton tanks for the storage of diesel oil, which can be delivered to river craft at the rate of 20 gallons per minute. It also has smaller tanks for TVO vaporizing oil, for kerosine for navigation lights, lamps, cooking and cleaning, and a full range of marine lubricants and greases is also carried. Primarily it was provided for fueling the vessels of the Thames Passenger Service Association, but its facilities are also available for private river craft.

## The Royal Dutch/Shell Group

The Shell Transport and Trading Co. Ltd. and the Royal Dutch Petroleum Co. are holding companies in the Royal Dutch/Shell Group, the operating companies being the Anglo-Saxon Petroleum Co. and the Shell Petroleum Co. Ltd. having their head offices in London, and the N.V. de Bataafsche Petroleum Maatschappij having its head office in The Hague.

Sir Geo. Legh-Jones has resigned as a managing director of the operating companies and the board has accepted his resignation with regret. He will remain a managing director of Shell Transport and Trading Co.

The Group's net profits for the year ending December 1950 are over £49,000,000 ($13,720,000) being nearly 13½ million pounds more than in 1949.

About two-thirds of the income has been appropriated for retention in the business and one-third distributed in dividends to the two holding companies in proportion to their holdings. Crude production of the Group has increased by 13 percent as compared with a general increase of 12 percent in world production. During the year the Group has placed orders for 46 tankers of a total deadweight tonnage of almost 900,000 tons.

## Air Separation Plants

Petrocarbon Ltd., an associate of Manchester Oil Refineries, Ltd., announces that its "Air Separation Plants for Oxygen, Nitrogen and Rare Gases" are now in commercial production in Great Britain. They are designed for the large or small scale production of the above gases as well as technical argon.

## Esso Appointments

In addition to the previously reported appointment of Leonard Sinclair as chairman of the Esso Petroleum Co. in succession to the late R. A. Carder, W. E. Jenkins O.B.E. and N. F. Myers have been appointed managing directors of the company. Mr. Jenkins, whose age is 58, joined

William E. Jenkins

the company in 1920 and was appointed director in 1945. He was awarded the O.B.E. in 1949 for his services as controller of the finance and accounts division of the Petroleum Board during the late war.

Mr. Myers, age 49, is an American and a graduate of the Massachusetts Institute of Technology. He was appointed a director in 1950 and is primarily concerned with the construction and erection of the new Fawley refinery.

Norval F. Myers

H. C. Tett has been appointed a director of the Esso Petroleum Co. He is 45 years of age, and is a B.Sc. of London University and an associate of the Royal College of Science. He was formerly managing director of the Esso Development Co., before being appointed general sales manager of the Esso Petroleum Co. in 1949. He is a vice president of the Institute of Petroleum, and a member of the British Committee of the World Petroleum Congress.

## Shell West Africa Manager

R. H. Cain

Robert H. Cain V.C. has been appointed general manager of the Shell Co. of West Africa Ltd. He is 45 and gained the V.C. as a major with the First Airborne Division at Arnhem in 1944. He is the only one of five who were later awarded that decoration who survived the battle. He joined the Shell Group in 1928, and in January 1946 was one of the members of the staff flown out to Malaya to assist the British military administration in clearing up that country after the Japanese occupation.

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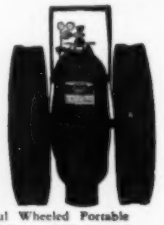

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## Secondary Recovery

*(Continued from page 37)*

This direction, when recognized, will determine the direction of flow of underground fluids and thus the relative positions of the input wells and the spacing pattern (whether square or oblong). If the permeability is variable the various streaks may be selectively plugged (if possible) so that pressure of the recovering fluid will bear heaviest on areas of high and lightest on streaks of low permeability.

For the production operations, the engineer will take note of modern trends in secondary recovery. These trends are to wider well spacing, to higher injection pressures, to the use of wet gas (where available) to swell the original oil, thus reducing its viscosity and making it easier to move; to the use of brines in water-floods instead of fresh water, and to circulate the water in closed instead of open systems. There is also a strong trend to produce secondary recovery wells by flowing instead of pumping, thus saving much cost and emulsion troubles. This requires higher input pressures in gas repressuring. A new feature in gas injection is the use of small-diameter "flow springs" to segregate small amounts of oil accompanying the injected gas so that the producing well can be flowed intermittently rather than pumped intermittently. In this device, which is successful at depths of 300-1,100 feet, the energy remaining in the injected gas is utilized after passing through the sand to lift the oil by siphon—flowing it to the surface It has been employed in 209 wells of the Oil City district where it has lowered development costs and increased ultimate recovery in low-productivity fields. In water floods where much water has to be lifted in proportion to oil, submersible electric pumps have proved most useful.

It is impracticable here to extend this list of particulars which research and experience have made available for enhancing the art of secondary recovery in the matter of certainty and economy, and the researchers are still prosecuting studies on ideas for further improvement, particularly to make the oil flow better and faster. For example, there is the question of "motility" or the use of wetting agents to "lubricate" the passage of the oil out of the narrow pores of the sand. Then there is a question of injecting hot water into the bottom of the hole, which has been found to give the advantage of a permanent increase of permeability near the bore. Another important suggestion is to reverse the relation between producing wells and input wells by making the producing wells into input wells; surprising success has followed. One inconvenient circumstance in water-floods is the long interval between the beginning of input and the appearance of oil in the producers. This is helped by putting a vacuum on the still empty producer so that the water is pulled as well as pushed through the sand. Many of the new suggestions will no doubt sooner or later take their place in practice.

Research has made and is still making valuable contributions to the art; but the greatest single boon that could now come to secondary recovery would be removal of obstacles that prevent unitization of oil pools.

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## Air Drilling in Seismic Surveys

*(continued from page 38)*

Boaz, New Mexico, which is in the sand dunes about 50 miles northeast of Roswell. Water was a real problem there due to blind holes and about eight to 12 miles of water hauling over the dunes which took anywhere from 2½ to 3½ hours for each trip. Under these conditions usually two 1000-gallon water trucks were continuously going back and forth. The holes were fairly easy digging to a depth of about 140 feet and the time for each averaged only about one hour, but due to water hauling and to some extent to the slow pace from shot point to shot point only three holes could be drilled in one day. In trying air in this area three holes a day were also drilled, but the actual drilling time was longer due to the sand and gravel falling in. There were no expensive and long drawn out water hauls but the water truck was on the scene during this experimentation. The drill pipe had a tendency to stick when the sand and gravel was packed around it, but by pumping a small amount of water through the drill stem the sand and gravel loosened up enough to permit freeing the pipe. At first, water was added from the top of the hole outside of the drill pipe in the hope that it would help hold the sand, but that proved to be a mistake as it only aided in packing the sand tighter against the drill stem.

The advantages of using air instead of water to remove cuttings from holes in areas to which the method is applicable might be summarized as follows:

(1) The time and expense of long water hauls is eliminated and all the drilling personnel is kept at the rig at all times.

(2) The water truck is usually the one that travels most, making tracks over the same route again and again. In many instances this tears up the roads and fields to such an extent that not only do they spend much time getting out of mud holes, but sometimes are refused admittance to such roads and fields.

(3) The shot hole location is kept cleaner by the elimination of the slush pit and slush; also there would be less danger of injury to cattle which sometimes causes damage claims or law suits.

(4) Substitution of air eliminates digging slush pits in hard ground and then having to fill them up, or it will do away with having to haul a portable pit on the rig.

(5) The hazards of winter drilling are reduced. There is no worry about the pump freezing and the cold wet clothes and shoes the drillers usually have no longer impose the threat of colds and sickness.

(6) Air drilling has proved to be faster in some areas than water drilling, and it seems to be a little bit easier on the rock bit cones and bearings.

**Mobile air compressor unit used in connection with shot hole drilling rig.**

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## Aromatics Adsorption Process

Sun Oil Co. has developed the Arosorb Process, a new process to separate aromatics which is a commercial development of the analytical tool of silica gel adsorption used by Dr. F. D. Rossini, of the American Petroleum Institute's Project No. 6 in his work on the analysis of petroleum. Sun research teams have spent more than eight years in developing the present process.

First commercial plant costing over $8,000,000 will be erected at Sun's Marcus Hook refinery in connection with a 10,000-barrel catalytic reformer. The new plant will produce 13,000,000 gallons per year of benzene, 30,000,000 gallons per year of toluene, and 15,000,000 gallons per year of xylenes.

Flexibility of the process permits adapting it to the recovery of other products such as DDT solvents and other solvents, improved furnace and diesel oils. It can be used by other industries for the separation of chemicals otherwise difficult to recover or purify.

In the process a stream containing the desired aromatics is passed through a bed of silica gel which retains the aromatic portion and allows the saturated portion to pass out the bottom of the bed. When the capacity of the gel for adsorption of aromatics has been reached, the feed is shut off and the gel bed desorbed. One of two desorbents washes out of the bed the residual saturate material from the charge stock and then the other desorbent gradually desorbs or displaces the aromatics adsorbed on the gel. When desorption is substantially complete, the charge stock is readmitted and the cycle repeated.

In actual operation of the process as it will be applied in Sun's Marcus Hook refinery the feed stock and the two desorbents enter the top of the case in suitable sequence through the inlet manifold. The saturate effluent flows to a train of two distillation columns, in the first of which desorbent "B" is removed as an overhead product and recycled. The saturate portion of the charge is recovered overhead in the second fractionator, with desorbent "A" as a bottoms which is also recycled. The aromatic effluent is similarly handled except that, since a mixture of benzene and toluene will be processed, a third tower is added to the train to act as a benzene-toluene splitter.

Desorbents "A" and "B" are hydrocarbon streams having boiling points different from those of the charge stock. In Sun's plant desorbent "A" will consist of mixed xylenes and desorbent "B" will be butane. About two barrels of desorbent "A" and 0.5 barrel of desorbent "B" will be required per barrel of charge or, by analogy with solvent refining, a solvent dosage of 250 percent. However, in the Arosorber, four-fifths of the "solvent" is taken as a bottoms product and does not need to be distilled.

The figures above are for a feed containing 35 percent aromatics. The ratio of desorbents to charge would decrease with a lower-aromatic content feed and increase with a higher aromatic feed.

The Sun unit will have six silica gel cases ten feet in diameter and about 20 feet high and containing a total of approximately 500,000 pounds of gel. The gel used is a special form of silica gel supplied by the Davison Chemical Corp. of Baltimore, and developed by them in co-operation with Sun's research staff over the past several years.

Each silica gel case will go through 15 cycles per day or one about every 100 minutes. The cycles are staggered to provide substantially continuous operation in so far as the balance of the plant is concerned.

A gel life of one year is predicted from pilot plant life studies. The gel will be protected from moisture and other poisons by regenerative, pretreatment driers on each of the three streams feeding the cases. At the end of its life the gel will be discarded. Replacement of gel can be accomplished in one case at a time thus not destroying continuity of operation.

Recovery of 98 percent aromatics is about 90 percent. At 90 percent purity 98 percent recovery is attained. No problem is experienced in making specification benzene and toluene other than that a light sulfuric acid treatment is usually required to meet the acid wash specification. Not much acid is required as olefins, which cause off-test acid wash, are largely rejected to the saturate product.

The cyclic operation of the gel cases is automatically controlled by a cycle timer. The effluent is accurately and automatically cut from the saturate to the aromatic product line by an instrument developed by Sun which switches product valves after a measured characteristic of the effluent, such as refractive index, passes through a minimum.

Houdry Process Corp. and Universal Oil Products Co. are being appointed as agents authorized to license the process. Cost of a unit designed to produce 1,000 B/D of aromatics on a ten-year depreciation basis is estimated at $1,200,000. Such a plant would have an operating cost of 6½ cents per gallon of product. A 2,000-barrel unit would cost about $1,900,000 and produce aromatics at a cost of five cents per gallon.

## Drills on Mexican Concession

Five years after being awarded Mexico's only known concession since 1938 to drill for oil independently of Petroleos Mexicanos, Hilario Millan is now sinking his first well. The concession, granted on July 18, 1946, provides for the exploration and development of 30,000 hectares in the municipality of San Ignacio, in the State of Sinaloa, for thirty years. Royalty is to be one-eighth but the government will obtain title to 50 percent of all areas proven productive. The concessionaire must drill three wells during the first three years. Should they not be producers, the operator has to drill a well a year for each non-commercial hole. Or the contractor may abandon one-third of the land, and drill only two wells per year, assuming all three were dry the first three years. Or he may abandon two-thirds of the territory and drill only one well a year or abandon the entire project.

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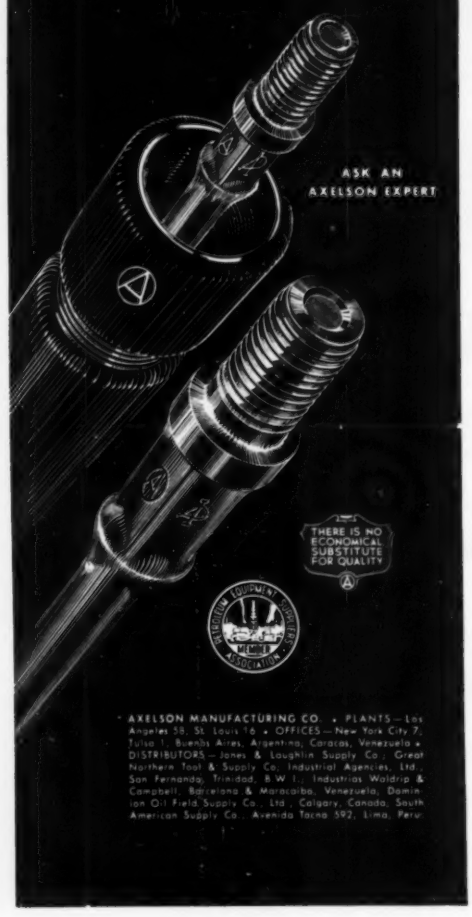

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SPIRAX LETTERS—NO. 7

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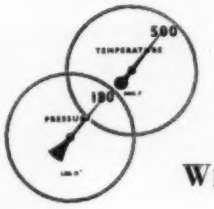


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When the Superheated steam in contact with the heating surface has parted with some heat, the heat from the rest has to pass by conduction through the bad conducting gas before it can reach the surface and replace the cooler steam. That takes time.

And here is another considerable difficulty. That part of the Superheated steam which has been brought down to Saturation temperature begins to condense and to give up its heat much more rapidly than the steam which is still Superheated. This behaviour gives rise to irregularity of temperature over the surface of heat transfer.

There is, then, no advantage and generally serious disadvantages in using Superheated steam for process heating.

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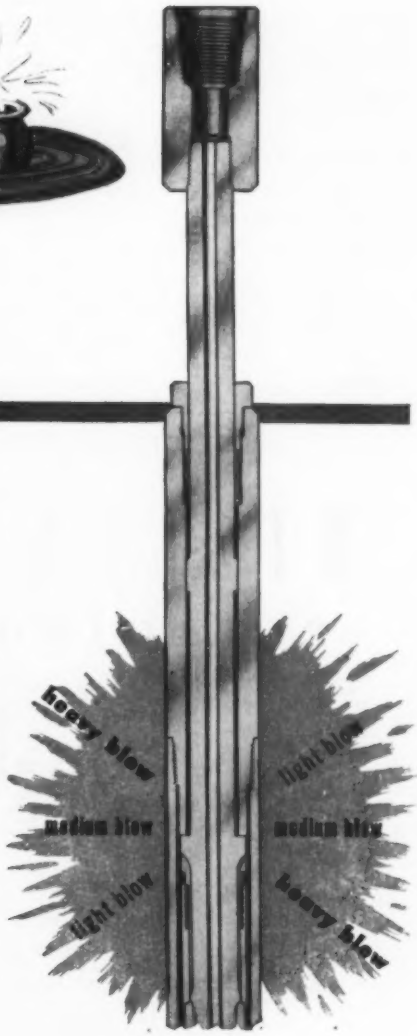


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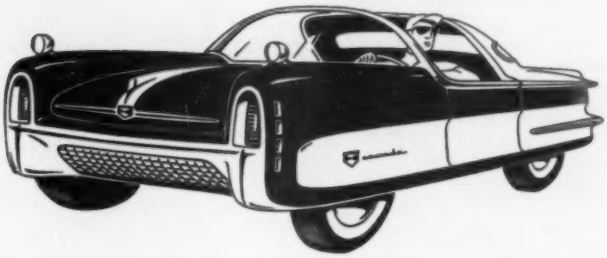

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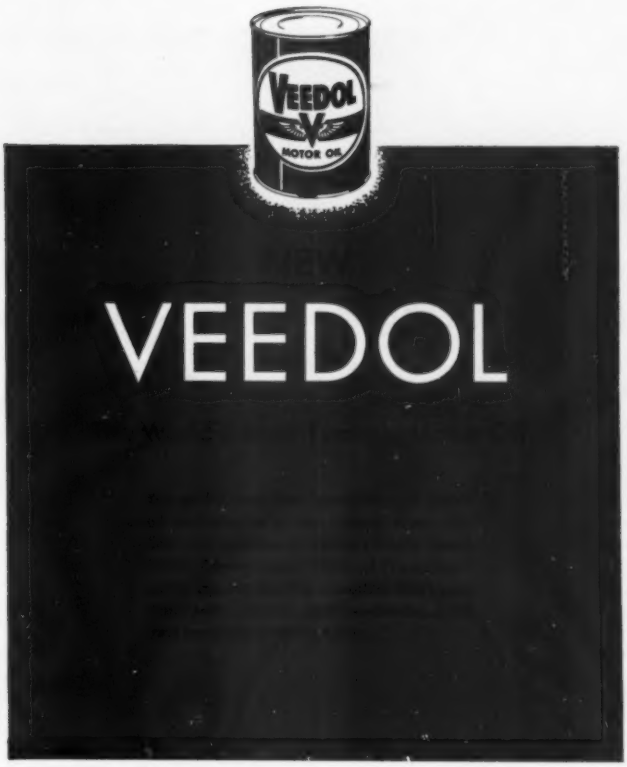


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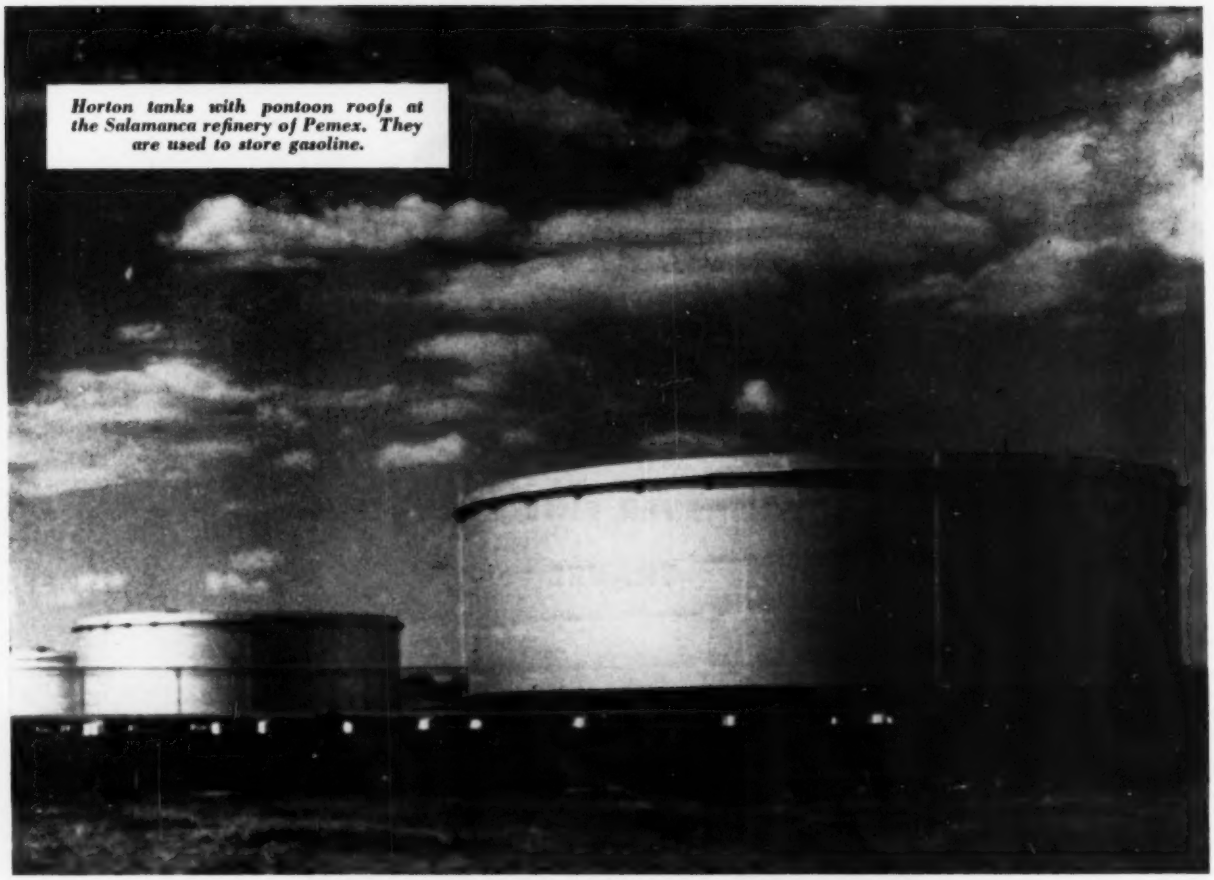

*Horton tanks with pontoon roofs at the Salamanca refinery of Pemex. They are used to store gasoline.*

# Why Many Modern Refineries Choose Horton Floating Roofs

*Why do modern refineries throughout the world choose Horton Floating Roofs for oil storage tanks?*

Principally because they know that Horton Floating Roofs provide more efficient and economical storage of volatile hydrocarbons. Proof of this superior performance can be found in hundreds of installations.

Here are two features that make the difference:

1. Stops Evaporation Losses—Horton Floating Roofs actually ride on the liquid in the tank and eliminate any air space where rich vapors might gather and eventually escape. This effectively stops breathing and filling losses.
2. Reduces Sulphide Corrosion—By resting on the surface of the liquid, Horton Floating Roofs don't permit a corrosive mixture of hydrogen sulphide, oxygen and water to form and begin its destructive work.

There are three types of Horton Floating Roofs for the protection of volatile hydrocarbons—the Pan—the Pontoon—and the Double Deck. Write our nearest office for more complete information.

**EVAPORATION LOSS IN BARRELS OF 42 U.S. GAL.**

| TANK SIZE | Gastight Cone Roof | | Horton Floating Roof | |
|---|---|---|---|---|
| Capacity in Barrels | Annual Breathing | One Filling | Annual Breathing | One Filling |
| 10,000 | 150 | 8 | 32 | 0 |
| 20,000 | 268 | 16 | 46 | 0 |
| 30,000 | 375 | 24 | 57 | 0 |
| 40,000 | 480 | 32 | 64 | 0 |
| 50,000 | 575 | 40 | 70 | 0 |
| 60,000 | 672 | 48 | 78 | 0 |
| 70,000 | 763 | 56 | 84 | 0 |
| 80,000 | 848 | 64 | 88 | 0 |
| 100,000 | 1,030 | 80 | 100 | 0 |

*The losses shown in the table above are based on a Mid-Continent Crude having an API gravity of 38 degrees. The cone roof tanks average one-third full.*

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*"Our industry cannot risk the loss of confidence which would result if we failed to push forward soundly in the field of product quality, development of new products, and new applications of old products. We cannot relax in our expenditures and efforts in scientific research of all kinds."*

*From a speech by Eugene Holman, President, Standard Oil Company (New Jersey), September 16, 1948*

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